

THE ROAD TO SUCCESS IN AFRICA IS PAVED IN ASPHALT:
TRANSPORTATION INFRASTRUCTURE DEVELOPMENT
IN EMERGING ECONOMIES AS A WAY TO ACHIEVE
NATIONAL STRATEGIC POLICY OBJECTIVES

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Strategic Studies

by

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ABSTRACT

THE ROAD TO SUCCESS IN AFRICA IS PAVED IN ASPHALT:
TRANSPORTATION INFRASTRUCTURE DEVELOPMENT IN EMERGING
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CHAPTER 1

INTRODUCTION

The purpose of this thesis is to explore the importance that a dramatic improvement in the infrastructure of underdeveloped areas can have, especially in an area where the United States has a specific strategic interest. Every geographical area brings its own complications and challenges, but the Horn of Africa is particularly challenging given the general dearth of major roads and the area's strategic importance.

Most of the paved roads in Africa are in and around the major cities and were built in the late 19th and early 20th centuries. Travel throughout most of Sub-Saharan Africa is slow and tedious along unlit, unpaved roads that wind around villages, topography, and hydrology terrain features. While the major premise of the thesis is development of roads, it is rooted in the theory that building these roads will provide lines of communication, along with the possible concurrent development of rail, telecommunications, and airports. To effectively highlight the complex issues posed by such a large-scale endeavor, this thesis will focus on the nation of Ethiopia as the subject of its plausibility probe.

All the way back to antiquity, roads have played a vital role in military history. The roads built by Rome throughout the western world provide an early example. These roads, many of which still exist today, influenced the spread of ideas and trade. They impacted the conduct of warfare and success of nation building. In the Twentieth Century, roads built during World War II found both the Chinese and Allied Powers developing strategic highways in underdeveloped areas. Though this was largely for their

own causes, the roads also assisted the underdeveloped nations through which these roads were constructed by providing new modes of sustenance, trade, and communication.

These case studies provide examples and precedents of the challenges and benefits that resulted and will be studied in depth as part of the research process. Of particular note, this study will look at the difficulties and consequences that resulted when nations hesitated to begin infrastructure projects until the period of conflict had already begun, instead of proceeding with the undertakings beforehand. The recent wars in Iraq and Afghanistan also illustrate problems inherent with waiting until hostilities begin to start developing infrastructure considering the importance and effect of infrastructure during counterinsurgencies.

This study provides a simple analysis, based upon historical research, on the cost required to build highway infrastructure in Sub-Saharan Africa. Analysis will also focus on the benefits derived from the creation of jobs, intrastate and interstate trade opportunities, and other resulting positive economic effects. Research will explore the possibilities for the training of host nation security forces as well as collaboration with international development organizations and private industry.

Based on the research and models provided in this examination, it is asserted that a comprehensive plan for infrastructure development in Africa, particularly of ground lines of transportation, would benefit the United States strategically, economically, and politically. The study is performed in three steps. First, an analysis of historical road and infrastructure construction projects was carried out. Second, an analysis of cost was conducted, considering money currently being spent in Africa and the costs of fighting small wars in Iraq and Afghanistan. Third, an examination was executed regarding the

possibilities, constraints, and limitations of planning an international effort as required to undertake such a massive infrastructure development.

Primary Research Question

How would a major roadway infrastructure project in Ethiopia benefit the United States' Strategic Interests?

Secondary Research Questions

How would an improvement of highway infrastructure benefit the nation of Ethiopia?

How would a major roadway infrastructure project best be conducted?

How does infrastructure development fit within the current national strategy?

Definitions

Human Transportation Availability Factor (HTAF)—The measured distance of roadway divided by the number of people living within a country. This number determines the per capita access of roadways for the population. The number is based upon total measured roadways. Reported data is not specific enough to consider only paved roadways.

Limitations

Since traveling to Africa was not an option, first-hand knowledge of the physical and human terrain in the chosen area could not be gathered. Additionally, Chinese and Indian contractors currently conducting infrastructure development within this area have not made their plans and scope of work public. Finally, access to strategic planning priorities for AFRICOM are not available as at the time of this writing. They are in an

amorphous stage based on the shift of national strategic priority to Asia-Pacific and the budget uncertainty pervasive in the 2013-2014 timeframe. Instead, testimony to Congress in the form of the 2014 posture statements for AFRICOM will be used to divine this intent.

Delimitations

This study will not conduct a deep analysis into simple, easily mitigated risk. There are far too many variables to consider based upon what method of construction and development are chosen, and who is chosen to undertake the project. This research is meant to analyze whether the infrastructure development is a worthwhile idea, and discuss the ways that it could possibly benefit all parties involved. Therefore only general risk, seen from a strategic or regional standpoint, will be investigated.

In addition to the lack of firsthand knowledge of the operating environment for the study, the thesis will be limited to a narrow focus, by looking at only one nation. This will result in the possibility that some conclusions based upon terrain, government, economics, and culture will not seamlessly translate into the broad scope of African nations and broader scope of developing nations worldwide.

Conclusion

This thesis explores the effects of the infrastructure development operations from a Political, Military, Economic, Social, Infrastructure, Information, Physical Environment, and Time (PMESII-PT) model. An in-depth data analysis in chapter 3 will investigate the need for highway infrastructure development in Ethiopia. The study will then discuss the current employment of investment and infrastructure development by

America's economic competitors, namely China, India, and Russia. Chapter 5 provides a conclusion discussing the strategic applicability of this study as well as possibilities for support for such a project, in order to fully develop the project from a whole of government and multi-national coalition approach. The conclusion also includes recommendations for further study on the subject.

CHAPTER 2

LITERATURE REVIEW

The literature available for this study comes from four major publication types: historical context, academic papers, economic data, and current doctrine and policy. First, there are many books written about historical road construction and the effects of roads on culture and civilizations throughout history. Looking at a historical context enables the understanding of why civilizations attempt to connect to each other, whether cities or nations, by the use of high-speed roads. Historical context also provides great detail on the immediate causes for the successes or failures of these projects.

Second, there are many studies done by strategists, economists, and military professionals on the subject. These include the successes and failures of road-construction during counterinsurgencies, particularly in Afghanistan. Published works on the development of infrastructure as a matter of foreign policy will show past and present views of enlightened academia. The current involvement of world powers in the economic development of nations in Africa has also been written about in depth and bears direct relevance to the study.

The third area of source material is economic data relating to nations' economies and infrastructures. This data lays the groundwork to establish the need for the proposed development in Africa and particularly in Ethiopia. In order to maintain consistency and legitimacy for economic analysis, all data utilized for comparison and trend formulas was drawn from a single trusted source, the Central Intelligence Agency's World Factbook.

Finally, current United States Army Doctrine and United States Strategic Policy Papers, which speak to the United States Government's plans for the near future when

concerning engagement and infrastructure development in emerging economies, are examined in concurrence with the aforementioned sources. As these writings lay out future plans for engagement with nations in Africa and the rest of the world, they will provide an understanding of how the topic of this study can fit into America's foreign policy and how large scale infrastructure development projects can fulfill a strategic need.

In addition to the four major forms of literature are media and trade publication websites. This set of literature provides the most current raw data about progressing events. These sources feed current points of view into understanding how the future is beginning to shape. This enables future research to define problem sets and reinforces the proposal of likely solutions.

History and Cultural Impact of Roadway Construction

Wilfred Owen's *Transportation for Cities, the Role of Federal Policy* is a cost-benefit analysis of the money paid by taxpayers for transportation infrastructure developments in the United States. The scope of the problem from a holistic point of view is proving that elements of infrastructure development can have a beneficial or detrimental effect on society and economy, depending on how well the projects are planned and implemented (Owen 1976). Many roads in the developing world are quite unsafe for travel, with narrow lanes, steep grades, slopes, and sharp angles at turns. This is particularly true in wooded and mountainous terrain where visibility can be hampered by obstacles. Modern road width standards range from four and a half meters to nine meters wide. Pavement under six and a half wide is generally considered narrow and unsafe. Roads narrower than modern standards are also susceptible to rapid deterioration,

as wheels rubbing the edges of the pavement cause structural damage to the roadway. Lane widths in the United States and other nations within the industrialized world are between two and a half meters and four meters to accommodate modern vehicles averaging three meters in width (Lay 1992).

As societies urbanize, they also tend to sprawl outwards from the city centers, creating pockets of suburban areas. These new population centers quickly develop the need for their own industries of food, services, and healthcare. The growth of these industries leads to the creation of new jobs; newly created jobs require transportation infrastructure suited to individual travel. In today's society, individual travel is carried out primarily by automobile (Owen 1976). Suddenly the traffic on these roads increases substantially.

Roads have been essential to humankind since prehistoric times. Evidence has been found that early Australian Aborigines used footpaths for trade. They would improve the paths continuously by removing stones from the path and piling them on the sides. These footpath roadways were geographically located as a function of terrain, stretching between major population centers to enable communication and trade. Due to common and frequent use, the footpaths were well worn and easily distinguishable as the compaction of terrain led to fauna growth that was clearly discernible from the surrounding ground. The roadways were limited to higher ground, eliminating use of the low areas, where bogs, marshes, and watersheds would naturally inhibit movement. Because of their predominance on high ground, these became known as ridgeways (Lay 1992).

By 3000BC, ridgeways could be found in Australia, Asia, Africa, and Europe. They were commonly used for the trade of salt, tin, bronze and other goods. Paths to markets and coastal shipping were eventually referred to as portways. Ridgeways were also common in North America. One of the most famous ridgeways, The Natchez Trace, is still in existence today in the form of a Tennessee parkway (Lay 1992).

As technology advanced, so did the construct of roads. With the introduction of the chariot on the British Isles, the roadways improved. In order to suit the chariots, they became wide enough and hard enough to promote wheeled travel. Julius Caesar wrote of the disassembling of a Celtic tribe following their defeat, as their general “disbanded most of his forces, keeping only some four thousand charioteers. . . . He sent his charioteers out of the woods by every road and track” (Lay 1992). These same roads that Caesar’s enemy used to retreat were eventually used against him, and led to his defeat at the hands of the Britons in Kent in 55BC.

The very first paved roads were located in the Babylonian Empire. The invention of Mesopotamian Engineers before 1200 B.C., these roads were built using large flat bricks set in a mortar of lime, sand, and asphalt, and covered in large flat limestone flags. They were used as procession ways for the gods, idols carried on chariots and wagons. The hard, even, flat grading made for a smooth ride for these deities, ensuring their pleasure during ceremonies. Over time, other major thoroughfares within Mesopotamian cities became similarly paved, as their utility to increase trade became apparent (de Camp 1993). Some roads even extended out of the cities; however, it was not until the Roman Empire that intercity roads were paved over their entire length.

Around 300 B.C. the Romans discovered sandy volcanic ash near Mount Vesuvius. They combined this ash with lime mortar to make made cement that dried rock hard, and even hardened under water. By adding aggregate of sand and gravel, concrete had arrived on the scene, revolutionizing road construction. With the invention of massive powered concrete mixers still a long way off, the Romans instead used wooden forms, laying the concrete in between and pressing the filling material into it. Additional layers of concrete were laid upon the last, creating depth and width. Improvements in technology continued as the Roman Empire continued its expansion (de Camp 1993).

Romans first demonstrated what road networks could do when they built the Appian Way. This famous roadway and 53,000 other miles of road were constructed with deep base courses and tightly fitting stone. They were crowned and often included drainage ditches. While evidence exists that irrigation canals to bring water to agriculture date back to 7000B.C. in Mesopotamia, this Roman architecture is the first evidence found of manipulating the ground to keep water flow away from roadways. Some roads through the mountains were specifically constructed by the Romans to catch early morning sunlight so as to be useable for transit all year long (Bahn 2000). The road network's infrastructure development took over 800 years to fully complete. The same roads that allowed for the Roman conquests and the creation of the greatest empire to that point, also led to their destruction, as Alaric and the Goth tribes marched along them on their way to sack Rome. These roads were built by Soldiers (Conover 2011).

The Appian Way stretched the length of Italy. Around 100 A.D., Trajan built roads that extended into the Italian provinces, as well as one that stretched all the way to Arabia. The Arabian roadway was paved and divided into two lanes separated by a row

of raised stones that safely enabled two way traffic (de Camp 1993). The Roman Emperor's primary intent for these roads was to enable the Army to quickly move to battle, reinforce allies, and provide logistical support to campaigns. However, the roads also supported trade, government administration, and correspondence (Bahn 2000). These roads were built extraordinarily well, even by modern standards of depth and material, as Roman builders of the time believed that a solidly built road would not require much maintenance (de Camp 1993). The same roads that allowed for the Roman's expansion and the creation of the largest empire in the world up to that point, also led to their destruction. Alaric and Goth tribes from the northeastern frontiers marched along the same roads in their quest to sack Rome.

Many of the expeditionary Roman roads are still in existence today, including the Appian Way. Though mostly covered in asphalt, this roadway still has sections of the same imperial flagstones upon which the legions marched. However, from ancient times to the present, most of the roadways within cities passed the point of utility and fell out of use. In fact, most ancient city streets commonly used in Ancient Rome, Paris, and London are no longer in use or existence today. This transition was mainly due to the unprecedented growth in populations within the cities and the general non-permanence of structures. As roadways needed to be widened, buildings were commonly demolished and space was made for roads of utility (Lay 1992).

Roads, Cities, Governments and Economies

Hippodamus of Miletos (498-408 B.C.) was an ancient Greek architect and mathematician. He is credited as being the first historically recognized town planner. As a follower of Pythagoras, Hippodamus used geometric lines and right angles in the

reconstruction of his hometown of Miletus after it was sacked by the Persians. The result was a grid system of road networks. The grid simplified land subdivision, encouraged development, and eased urban navigation. Hippodamus' career continued and several other towns bore the grid system, now known as Milesian planning (Lay 1992).

This usage of a grid system for urban planning caught on quickly, spreading throughout the Roman Empire and beyond. During Hadrian's reign, circa 125 A.D., municipalities in Britannia were using the grid system to expand and enable the export of tin, iron, precious metals and agricultural products to Rome (Bunson 1994). In Europe, those cities that did not use the grid system contained winding narrow streets, especially in warmer climates, as the roadways between buildings provided escape from the ravages of brutal sunlight (Lay 1992). These were especially common in areas of routine conflict, as the randomness of the road system and lack of easily definable navigation patterns created a maze and assisted in the defense against invading foes.

Following the migration from the Roman Empire to Europe, the grid system continued to travel. It was used over a thousand years later across the Atlantic Ocean in the construction of some of the greatest American cities, including New York City, Philadelphia, and Chicago. Milesian planning was even utilized in planning systems for other cities, such as San Francisco, where topography didn't naturally suit the grid network (Lay 1992).

Another significant development to roadway planning and structuring occurred in the United States when Thomas Jefferson created the Land Ordinance Act of 1785. The act subdivided the thirteen colonies into parishes of six square miles. Each parish was then subdivided into thirty-six total one square mile units. Each one square mile unit was

subdivided by four, quartered into farms. Each farm had to donate 33 foot strips at its boundaries to create 66 foot wide roadways in between farms. The 66 foot roadway was based upon the 66-foot Gunter's chain used to survey the land. At this width, each road accommodated the turning radius of a horse and carriage team (Lay 1992).

John Loudon McAdam, a Scottish Roads Official in the early 1800s came up with the road-building principles known as macadam. The macadam method was different from existing methodology because instead of evenly cut stones creating a base course, no base course was needed, and instead, angular chunks of broken stone were held together by the natural interlock between pieces. A layer of smaller stones allowed the pressure of wheeled vehicles to further compact and harden the surface (Conover 2011).

The macadam revolution in road construction provided a low-cost method of creating all-weather roads in remote areas. Prohibitive costs could delay projects, but with macadam, the construction of a road network could be done in sections. Priority goes to creating all-weather paved roads in projected high-traffic areas, with low-traffic branches constructed utilizing all-weather macadam road implementation. This allows the project to start at a lower cost. As the economy develops alongside the new infrastructure, road improvement projects can continue until the entire highway system is complete.

Strategic Highways in the China-Burma-India Theatre of WWII

Two books provided historical perspectives of the same problem, namely the access to China's mainland during World War II and the Allies war against Imperial Japan. Tan Pei Ying's book provided a firsthand narrative history of his work as the managing director of the Yunnan-Burma Highway Engineering Administration. It describes the Chinese government's effort in building a new highway infrastructure in

underdeveloped areas in western China. The intent of the project was to ensure transportation was available inland, as the Empire of Japan was quickly dominating the coastline and taking away the littoral region from Chinese control.

Before the United States entered World War II, China was invaded by the powerful and expansionistic Imperial Japan. As Japan came from the east and dominated the littorals, Chinese leadership looked west to supply their people and their army. To enable these logistical needs, two strategic roadways were built: the Burma Road and the Ledo Road. The construction of these two roads was critically important to winning the war against Japan (Tan 1945). The Burma Road was built in the 1930s by approximately 200,000 Chinese and Burmese local civilian laborers, from deep inside their interior into Burma, present-day Myanmar. The road was a massive undertaking in human effort. The Ledo Road was built primarily by American forces, connecting China to India. Just as Russia was a strategically important second front against the Nazis in Germany, the Allied forces fighting in the Pacific knew that the Japanese needed to continue fighting not just in the Pacific, but on a second front inside mainland China (Anders 1965).

The Burma Road is the Strategic Road that runs from Wanting in Burma to Kunming in China, a distance of roughly 717 miles, though only 320 miles as the crow flies. The road was constructed through a very mountainous region, with differences in elevation of up to 5,500 feet. All but 117 miles were within China's borders (Tan 1945). Tan Pei-Ying, the managing director of the new highway, first conducted a thorough study of the geographical and geological background. This was necessary to ensure a full understanding of the terrain and problems that the road construction project would face. Tan knew that it would cost a lot more to build a road through swampland or land far

from rock quarries, than it would through land that was flat, dry, and rife with sedimentary rock that could be used in concrete. This helped him decide where, geographically, the road should ideally be constructed. He came up with a plan for the construction timeline: first to get the road open in any condition; second, to improve the road and cover it with gravel; and finally, refine the highway, straightening turns and reducing slopes to enable speed of transit (Tan 1945).

The Ledo Road was built years later, as the United States began preparations to enter the war and fight against Japan. Just as Russia was the second front in Europe against the Nazis, so China was the second front in the Pacific against the Japanese. The Ledo Road was required to provide logistical support from Allied Forces to the Chinese Army. Japan had successfully conquered or blockaded every port along the coast creating a gap through the systemic loss of entryways into mainland China.

Additionally, the French railway from Indochina (Vietnam) was no longer a viable route for the Allies following the fall of France in 1940. The British found themselves overstretched and under supplied by 1941 making dependence on them unrealistic in terms of supply sources. Russia and Japan had signed a non-aggression pact that same year, cutting off China's from its largest neighbor. With the passage of the Lend-Lease act in 1941, the United States needed to find a way to supply the Chinese resistance, which was imperative to keep Chinese forces in the field. Without China's forces to preoccupy Axis Powers, Japan would unabatedly continue its aggressive expansion throughout the Pacific Rim (Anders 1965).

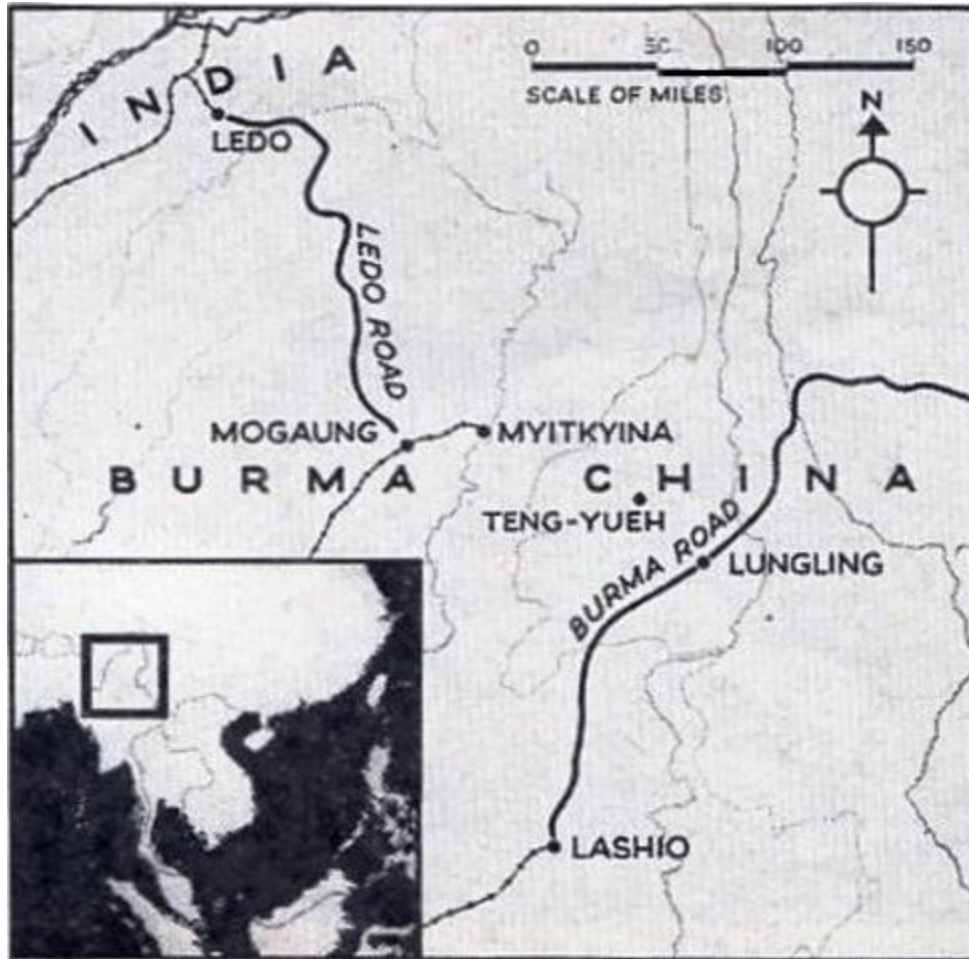


Figure 1. Map of Ledo Road

Source: *Life Magazine*, 1944, <http://cbi-theater.home.comcast.net/~cbi-theater/lifeledo/life-ledo.html> (accessed May 13, 2014).

The decision was made to draw up plans to establish a new highway from Ledo, a road and railway hub in eastern India along the Brahmaputra River to Wanting, China, a town astride the recently completed Burma Road. This 876 mile route was template to be completed within a year, so long as the engineer manpower, equipment, and material could be provided. After the bombing of Pearl Harbor, the United States became decisively engaged in supporting their strategically important partner in the Pacific. In

coordination with Chinese and British Engineers, a route was decided upon and in February 1942, the War Department approved the project and committed logistics to it. Unfortunately, during the winter, Japan had already made significant gains and conquered most of Burma, western Yunnan Province and coastal Southeast Asia. The United States military realized that until this road could be built, the preponderance of support to Chinese and Allied Forces in Asia would have to come from Strategic Bombing and resupply from air bases in India (Anders 1965).

Anders's volume is the from a decade later and the opposite side of the border as Tan. It tells the story of how United States Army Engineers built the road from India to Burma into China. This task eventually linked up with The Burma Road and completed the required ground transportation corridor necessary to continue the fight against Japanese aggression in mainland China. Both documents have intrinsic value as it can be compared and contrasted to ascertain the repeated issues that were incurred with similar projects and how both completed the wartime construction of a strategic highway. As of 2003 these two roads are now known together as the Burma Road, and are still in use, to one degree or another. The roadway links at least thirty-six different ethnic groups and tribes, and it serves as a channel for the trade of both licit goods, like teak, oil, and rubber as well as illicit goods like heroin and opium. For Assam, India, the road serves as its main economic artery, enabling the export of tea leaves from the local plantations and eight hundred thousand tons of coal a year from local mines (Webster 2003).

The pamphlet from the International Bank for reconstruction and development is a statistical analysis of the quantifiable benefits of transportation infrastructure development in the developing world. Its relevance lies within its methodology for

quantifying benefits. By utilizing some of the data, assumptions can be drawn that will enable the case to project possibilities for the theoretical construction that is at the heart of the proposed problem set (VanDerTak 1971).

Infrastructure Development and Current Strategic Concepts

Understanding the benefits that constructing roadways provide a counterinsurgency campaign is critical. This understanding determines the types of road projects that serve the greatest benefit to both the local economy, the government, and to security forces. Denying popular support for an uprising against those who built the roads is critical. Engagement must be made to show the legitimacy of those who were locally responsible for the increased quality of life that came along with the roads and promote them as the better alternative than extremist militias. Any helpful project taken alone would seem a gesture of goodwill. However, recent history tells us that some of these projects have been misguided and useless (Melin 2013). This thesis focuses on the optimal results to infrastructure development in a politically unstable developing world.

There are skills that should be taught to African Army Officers through the strategic partnership initiatives that western countries are currently pursuing in Africa. This premise is based upon the idea that these officers have generally been training in combat operations and tactics, and that when they retire to impoverished regions with poor infrastructure, they become angry and disillusioned with their government. They then form the base of popular uprisings that rebel in a coup d'état to overthrow their leaders. In order to prevent this, coalition forces can teach them actual skills so that they can get jobs upon retirement from the armed forces. These jobs should focus on the technical expertise necessary to upgrade African infrastructure. It would be beneficial for

the nations in sub-Saharan Africa to have a skilled workforce to carry out this type of construction. There must be a focus for infrastructure development as well as money to build, and these must be included in any plan for development (Chido 2011).

India has been actively conducting economic partnership and infrastructure development with African nations. There have been successes and missteps in their investment, the costs have led to a generally beneficial effect for both parties. As most foreign-financed development has targeted specific resources, there has been no holistic infrastructure development in Sub-Saharan Africa (Pham 2011). Assistance as far as security, support for liberation movements, and infrastructure development has directly benefited trade. Pham's work and the African Development Bank Group's Economic Report from May 2011, specifically outline Africa's trade with India. These provide a basis for understanding the specific ties that growing economies have with the developing world.

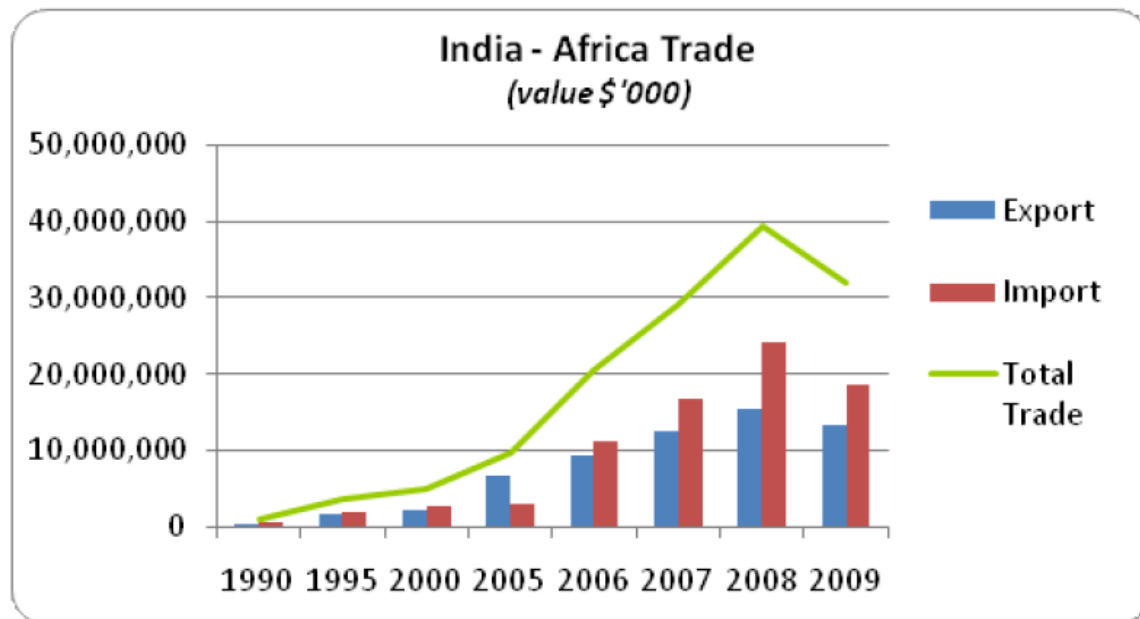


Figure 2. Graph of Increasing Trade Between India and Africa

Source: The African Development Bank Group, “India’s Economic Engagement with Africa,” *Africa Economic Brief* 2, no. 6 (May 2011): 2, <http://www.afdb.org/fileadmin/uploads/afdb/Documents/Publications/India's%20Economic%20Engagement%20with%20Africa.pdf> (accessed May 12, 2014).

Though there are many proposed solutions throughout the world for increasing human transportation availability while limiting road congestion, including more roads, intelligent transportation systems that alert travelers to new routes, advanced rail systems, high occupancy vehicle lanes, bus lanes, flexible work hours, and telecommuting, most are not relevant to an emerging market with an agriculture based economy. Policymakers worldwide tend not to get involved because there is little hard evidence to show how economically efficient transportation would work (Winston 1998). Each different approach has a downside that is severely limiting, particularly in the short term. A region that increases the availability of highways reduces the need for mass transit, resulting in

more people driving and more congestion. While each risk highlights the need for a comprehensive approach to transportation infrastructure development, there is clearly a realm in which any improvement in the sector will benefit the economy overall.

Ethiopia is an interesting subject for this type of development, as a nation definitely searching for additional outlets. As a landlocked nation, Ethiopia must rely on its direct neighbors for trade. The ruling party in Addis Ababa, Haile Selasse and Robert Mengistu historically have sought to control Eritrea, even fighting a brutal civil war resulting in Eritrea's total independence and a peacekeeping force in the early 2000s. However, the need to access the ports at Massawa and Aseb on the Red Sea remained and the two nations came to an amicable trade agreement. Additional trade along railway to the port at Djibouti and along the long road to Nairobi in Kenya makes up the rest of the major export movement (Arnold 2000). Recently, some trade has begun to Berbera in Somalia, and should continue as long as the security situation does not deteriorate.

Policy and Doctrine

The overall intent of this study is to advance the purpose of peace through proactive infrastructure development. In order to properly propose a planning framework, the end state of a peaceful country unlikely to collapse into an insurgency must be the goal. Through an analysis of Galula's principles, as it relates to infrastructure, terrain, and geography, certain conditions are presented that are particularly amenable to a safe and peaceful developing nation (Galula 2006). The policies set by the president will be the bedrock foundations for the study's recommendations. Department of Defense policy and US Army doctrine will provide the framework for how the military can enable the

strategic national interests in developing nations through stability operations (Department of the Army 2013a).

The commander of AFRICOM, the United States' Geographic Combatant Command in Africa, has stated that “reducing threats to the United States and the costs associated with intervention in Africa will ultimately hinge on the long-term development of effective and democratic partner nation security institutions and professional forces that respect civilian authority” (AFRICOM 2014). GEN Rodriguez clearly states that a long term approach is required. He also makes note of the need for professionalism within the armed forces of African nations. When speaking directly about regional instability, he notes that “food insecurity and access to natural resources, including water, can exacerbate state weakness, drive human migration, and heighten social disruptions and regional tensions.” He clearly highlights access as a problem.

With 80 percent of UN peacekeeping forces operating in Africa, there is an obvious need for capacity building and civil engagement. However, “failure of governments to deliver basic services to the people and enforce the rule of law has fueled distrust and fear in the government and security forces” (AFRICOM 2014). Here, the United States and other nations can help to build the capacity of the government and security forces to deliver essential services to the people and regain that trust. In countries with good governance, the international community can more judiciously provide assistance to help those nations move forward.

The United States Army has the capability of working throughout the world to develop nations. Regionally aligned forces (RAF) are those forces that provide a combatant commander with scalable, tailorable capabilities that enable the combatant

commander to shape the environment. This is intended to create security conditions more favorable to U.S. and allied interests, even in regions where the United States is not likely to commit to major combat operations. The Army shapes the environment through activities intended to establish trust, foster mutual understanding, and help partners build the capacity to defend themselves and prevent conflict. These include efforts that build partner capacity as well as civil affairs support for stabilization, reconstruction, and development. “Shaping the security environment diminishes regional tensions, enhances stability, and contributes to the security of the homeland. Therefore, as a common Army function, security cooperation is vital to American security interests” (Department of the Army 2013b).

Data

The wars in Iraq and Afghanistan has cost the U.S. almost \$1.5 trillion since 2001, according to the National Priorities Project, which studies federal spending. This includes the \$83 billion to be spent on the two wars in 2014, compared to the \$23 billion budgeted to be spent on foreign aid to all other nations. This data will enable simple analysis to show the economic feasibility of spending more on aid now that will have the effect of reducing our need to fight small wars in foreign lands. In order to maintain an even and fair analysis of the data, the preponderance of information and numbers used for the statistical analysis of this study is pulled from the CIA World Factbook, a non-partisan website that operates for informational reasons without any agenda.

Additional data is derived from websites and media organizations that outline specific statements from officials, plans and positions of government agencies, ministries as well as those of Non-Governmental Organizations (NGOs) and Intergovernmental

Organizations (IGOs.) This will allow analysis based upon the current conditions to understand the trends of what is happening or what is planned to happen that will shape the future world environment.

Summary

As the next chapter will detail, this data will be viewed through the scope of current policy and doctrine. This will allow an analysis of how historical successes can be built upon and implemented within the test case of Ethiopia. Synthesis of this information will develop ideas for how this type of project can be conducted and why it would be of strategic benefit to the United States of America and its partners throughout the world.

CHAPTER 3

RESEARCH METHODOLOGY

The first method utilized was a qualitative review of research documents on the history of roads and road conditions from ancient times to the present. This type of methodology was chosen because it provided information and understanding regarding the importance of ground lines of communication. Specifically this methodology was useful in understanding how goods, ideas, religion, and practices of civility have been transferred between peoples over time through the use of roads. This methodology also provides a focus on the benefits that roads have had on populations throughout antiquity. Analyzing the information gathered through this methodology helped determine the feasibility, obstacles, and planning priorities that need to be understood when considering the strategic implications of such a project.

The qualitative document review will continue into the construct of expeditionary roads during times of war. The point of this analysis will be to understand the hardships endured by engineers and identify the problems that are commonly found in this type of road construction project. Examples of these expeditionary war roads is the network of roadways built between inland China, Burma, and India during the Second World War, and the construction of the Tairin Kowt Road in Afghanistan.

The next step of the methodology was to analyze the economic benefit of highway infrastructure development projects in developing nations. Trend analysis, showed a specific link between undeveloped economies and undeveloped roadway infrastructure. There are some mathematical models and formulas available that show some elements of how transportation infrastructure effects economic growth, but these

are generally point to point, showing how two distinct regions can economically benefit by being directly linked by high-volume traffic capable infrastructure (Van der Tak 1971). As the proposed problem set is strategic and holistic, these specific models are of little use. Significant effort was spent by the author in attempting to create similar models and formulas, but was routinely stymied due to the ever increasing variable sets. These variables include type of government, type of economy, geographic location, population density, presence of interstate and intrastate conflict, ethnic strife, as well as chronological patterning issues caused by refugees, environmental, and humanitarian crises. Instead of ruling out so many data points that the formula becomes moot due to lack of universality, a trend analysis was used to show general themes.

The methodology includes analysis on the economic status of Ethiopia in comparison to other nations. This is for the purpose of gaining a perspective for the comparative cost of the project to the possible benefits based upon analysis on nation's sizes, populations, economies, and current transportation infrastructure. All information for economic trend analysis was pulled from the Central Intelligence Agency's World Factbook, accessed April 24, 2014. The data used is compiled in Appendix A. This will show the trends that support linkages between transportation infrastructure, economy, and human dignity.

Additionally, the analysis shows the issues that come along with attempting to build roads in a nation where our forces are already at war. The expectation must be that with a lower-threat area and far better security situation, projects of this nature progress far more smoothly and cost-effectively.

A simple analysis will show what money has been spent over the years for global outreach by interested parties, including allied nations, international organizations like the UN, and private industry. This analysis will determine the historical ends, ways, and means that have been employed by these entities for foreign infrastructure development. The primary source for this data will be the websites of the US Department of State and the US Agency for International Development (USAID). Taken together, this will be an analysis of the benefits of bringing high-speed ground lines of communication to regions that do not currently have a high traffic of trade and ideas.

Analysis will be given to any infrastructure project currently taking place directly as a result of trade, in order to show precedent and recent success. Analysis will also be given to the current, occasionally randomized approach to development in Africa, including micro loans, Doctors Without Borders, international pharmaceutical agreements to curb the spread of AIDS and malaria through cheap drugs, etc.

The final piece of analysis is the current funding levels of United Nations and international aid organizations into areas based upon the development level of the economy in that area. It includes the possibility for securing funding based upon the African Union's willingness to allow multinational corporations access to resources and markets. This methodology also includes analysis into the current development in Africa sponsored by other world powers, such as China, India, and Russia. By understanding what other countries are trying to accomplish in Africa, as well as the cost and benefits of certain lines of infrastructure development that the United States can pursue as part of the Regionally Aligned Force doctrine (Department of the Army 2013b). Facts and

assumptions were drawn to enable strategic planners to codify the means necessary to meet their desired end state.

Throughout the study, each piece of the analysis ties directly to the situation in Ethiopia as of March 2014. This allows the reader to understand how the strategic implications of foreign highway infrastructure development as a line of effort translate directly to the operational and tactical level. Ethiopia was chosen for several reasons. In the context of the two recent wars that the United States has been involved in, namely Iraq and Afghanistan, Ethiopia is also landlocked (Iraq has 58km of coastline). All three nations share borders with six other countries. All three nations have several different ethnic groups and religious differences. The sum of people in Iraq and Afghanistan roughly equals Ethiopia's population. All three nations, Afghanistan in 2001, Iraq in 2003, and Ethiopia today have an undeveloped highway system. During the US engagement in Iraq and Afghanistan, a significant effort was put forth to upgrade the GLOCs and the transportation infrastructure as a whole. This study will show the likely impact of such development prior to the breakout of high intensity conflict.

Although Ethiopia is chosen to focus the narrative of the study, the conclusions drawn are within the wider scope of national strategic policy and the general programs to support national interests. Although the data shows how transportation infrastructure development can help Ethiopia specifically, the underlying thesis is how it can serve as a line of effort within the entire developing world.

CHAPTER 4

ANALYSIS

In the 1980s and 1990s news media would run stories about Third-World countries and common knowledge held that the United States was a First-World country, as far from that poverty on TV charity ads as possible. When asking where the Second-World countries were, one could rarely get a coherent answer. It seemed the idea was that there was some kind of buffer between the haves and have-nots that has disappeared over time. Now, these same countries are called developed or developing nations. While the newer terminology may be more politically correct, it is also more intellectually honest.

It stands to reason that the developed nations are those that are developing the others. Such is the burden, or the honor, or the responsibility, of those that have. In order to do this, access must first be gained. A tourist can fly around to see these nations, but in order for them to truly develop, roads must be built. Paved roadways have gone hand in hand with the development of civilized nations since the beginning of written history.

One major problem of increasing trade is the increase in the weight of cargo conveying transports. This increase translates to more poundage per wheel and an increase of pressure on the roadway. Softer, less compacted roadways are severely vulnerable to rutting, especially under adverse conditions, such as rain and snow on dirt roads and extremely high temperatures for bituminous. Thus, a well constructed concrete road of sufficient width and compaction is necessary to facilitate the growth of trade by allowing for reliable transportation of goods (Lay 1992).

The construction of modern roadway infrastructure is a sign to the world that a nation is capable of surviving and thriving in the world economy. When one considers

that a major problem in the developing world, and specifically Ethiopia, is the lack of a national identity among its citizens, any major national improvement would help. The key to the strategy would be branding. It cannot be seen as a western road inside Ethiopia, but as an Ethiopian Highway system, planned and coordinated by the government and built by the citizens and Soldiers of Ethiopia. It would be an Ethiopian road network that linked all tribes together for the betterment of all.

For years, Peru has been considered a developing country and has been planning to build an intercoastal highway that would link the pacific coastal lowlands, where most of the population is centered, to Brazil, which is the economic powerhouse of South America. The problems that have plagued the projects beginning are two-fold. First, no one region can allow the highway to be built through a different region as this would forfeit a great economic windfall; thus, many announcements have resulted in riots. Second, any route would result in economic development of the Amazon Rainforest and would disrupt the ecosystem and habitats of many species, including the un-contacted indigenous peoples whose tribes still inhabit their ancestral lands within the rainforest (Conover 2011).

Any current roads that cross the Andes Mountains as one travels from the lowlands of Peru to Brazil are unimproved, of varying grade and fraught with danger. It is not uncommon for a cargo truck additionally laden with twenty or so passengers to stop on the incline of a mountain road, above 14,000 feet elevation and back up to a ledge, just inches from the ravine below, to allow an oncoming truck to pass. The same route, point to point that would take thirty minutes by airplane, can take over 24 hours by car or truck. Of course the dangers of infrequent and slow travel on dangerous roads are

offset by the dangers of high-speed travel on faster but safer roads, just due to the frequency, speed, and increase of traffic. In the same way, the economic benefits are somewhat offset. As the cargo truck driver can now make more frequent trips and carry more cargo, more drivers and vehicles will join the competition for that cargo and payment for conveyance will decline (Conover 2011).

Another problem for developing countries is the NGOs trying to protect the natural resources. After an encounter and follow-up with a lumber mill owner in Peru, Conover writes “his argument about developing the country by exploiting natural resources deserved a serious hearing. It wasn’t merely the self-serving credo of a rapacious businessman; on a larger scale, it was the dilemma faced by practically any country that was trying to feed its people while saving its nature at the same time—which is to say, practically every nation on earth” (Conover 2011).

Building Roads as a Line of Operation in Strategic Policy

Strategic Policy is created based upon the prevailing views within government. Watching the popular YouTube.com video uploaded by kolomaire (1000 Years of War in 5 Minutes) provides an excellent graphic depiction showing us that the world has been almost constantly in a state of conflict. This idea, in foreign policy circles, is known as realism, a focus on the shifting distribution of power among states. While it is true that the liberal idea of spreading democracy and the rule of law are based upon the fact that no democracies have ever gone to war against each other, many have fought against totalitarian regimes, and even more have fallen into civil war, as rival ethnic groups struggled for self-determination (Snyder 2004).

The diversity and complexity of the African continent offer the United States opportunities and challenges. As African states grow their economies and strengthen their democratic institutions and governance, America will continue to embrace effective partnerships. Our economic, security, and political cooperation will be consultative and encompass global, regional, and national priorities including access to open markets, conflict prevention, global peacekeeping, counterterrorism, and the protection of vital carbon sinks. The Administration will refocus its priorities on strategic interventions that can promote job creation and economic growth; combat corruption while strengthening good governance and accountability; responsibly improve the capacity of African security and rule of law sectors; and work through diplomatic dialogue to mitigate local and regional tensions before they become crises. We will also reinforce sustainable stability in key states like Nigeria and Kenya that are essential sub regional linchpins. (The President of the United States 2010)

The one thing that the developing world has is abundance in manpower. In 2011, the World Bank estimated that roughly 30 percent of Ethiopians were living in poverty (The World Bank 2014). Through partnership with US Army Engineers, Ethiopian Soldiers can be taught to properly design and construct modern roads. The Ethiopian government could easily put thousands to work in building these roads under the supervision of their Army. The populace would be happy to see their own people working and being paid, and they would see their own Army doing something to help their country. Not only would this help the government's image in the eyes of the people, but the money paid to the road workers would be spent in the local economies wherever the road project went.

China and India are both very proud of their roadway networks. China's roadway network can be seen in figure 2. The PRC recently announced a target of 53,000 miles by 2020. India has begun a 15-year project to pave and widen 40,000 miles of highway. Additionally, Kazakhstan plans to rebuild its highway linking China to the east and Russia to the west, which being called the new silk road, would strengthen the Trans-Siberian Highway (Conover 2011).



Figure 3. China's Modern Highway System

Source: Wendell Cox, "China Freeways: Continuing Expansion," January 2, 2013, <http://www.newgeography.com/content/003378-china-free-ways-continuing-expansion> (accessed May 14, 2014)

The construction of modern roadway infrastructure is a sign to the world that a nation is capable of surviving and thriving in the world economy. When one considers that a major problem in the developing world, and specifically Ethiopia, is the lack of a national identity among its citizens, any major national improvement would help. The key to the strategy would be branding. It cannot be seen as a western road inside Ethiopia, but as an Ethiopian Highway system, planned and coordinated by the

government and built by the citizens and Soldiers of Ethiopia. It would be an Ethiopian road network that linked all tribes together for the betterment of all.

While US foreign policy has desired for decades to make the world safe for democracy, this was primarily done during the Cold War by supporting democracies for better or for worse such as South Vietnam, and not supporting Marxist regimes, such as Cuba. Much less was done to shape the world and set the conditions for peace and democracy to succeed. Particularly in states containing several different ethnic groups, it would be easier for the people as a whole to accept an idea of nationalism if the different groups were more than interconnected by government, but also interdependent economically and equal in the rule of law.

The way to achieve regional stability in active foreign policy is through engagement. The US Army's Regionally Aligned Force concept is just the latest iteration of this idea and has significant opportunity to succeed. Used within a whole-of-government approach, a US Army unit could conceivably go to a developing nation, a fledgling democracy like Ethiopia, and build roads improving the economic infrastructure, enhance the rule of law through military police training teams, and in coordination with the Department of State, promote good governance. The trick is to get in and get it done well before conflict ever becomes necessary.

This cannot be a benevolent enterprise for the sake of doing something nice. The wars in Iraq and Afghanistan were extremely costly. The three lines of operation described in the last paragraph were all conducted, but under adverse and dangerous conditions at a staggering cost, but with mostly successful end states. It would be much easier, cheaper, and far less dangerous to conduct these types of operations during Phase

0, where security is far less of a primary concern than in Phase 1-4, where many times these efforts take a back seat to combined arms maneuver and wide area security operations. The obvious question is how we know that this is worth the money; that there will ever be a Phase 1-4. The realist answer is simple. In an area of newly discovered natural resources, where there is more tribal conflict than national identity, and where the possibility of pestilence and famine is always a consideration, history has shown that conflict is almost unavoidable. We must consider that regional stability can more easily be achieved for setting the conditions to stave off famine and disease, while promoting the economy and national identity and improving the rule of law and good governance. Security and stability are the intent, not merely benevolence. The reason that the United States should help build a modern roadway infrastructure within nations like Ethiopia would be because it serves our National Interests. The road to hell is paved with good intentions. The road to peace is paved in asphalt.

Infrastructure development as a line of effort will succeed in helping to improve the economies in developing nations and will ensure better income distribution among the populace. In the illustrations at the end of this thesis, a screenshot is taken from Google Maps on May 5th, 2014 of both France and Ethiopia. France is a developed nation with a strong economy. Ethiopia is a developing nation with a weak economy. According to the CIA World Factbook, France has approximately one third of the land mass and population of Ethiopia, but it has one hundred sixty nine times more paved roads. The maps clearly show the difference.

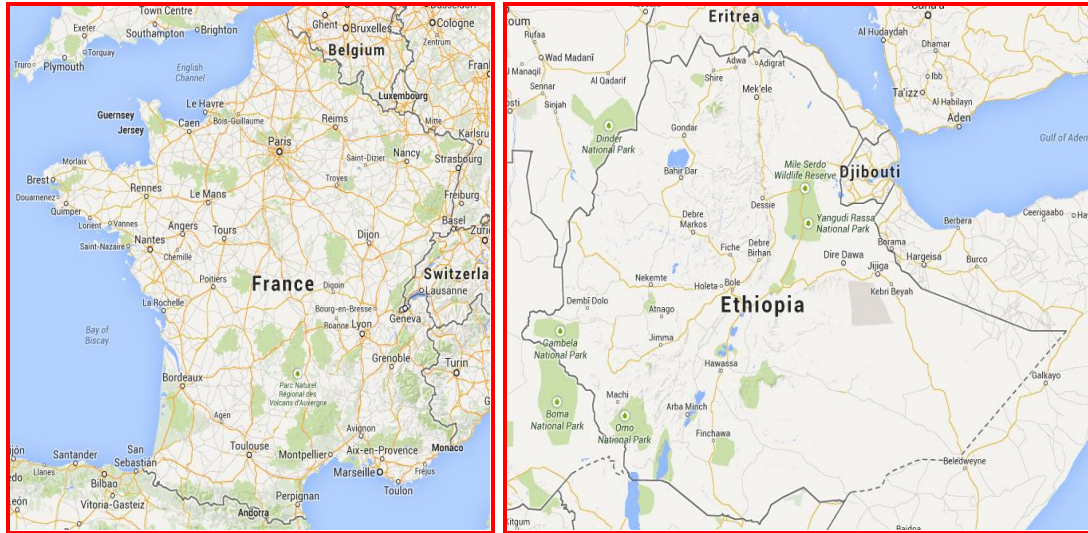


Figure 4. Roads in France and Ethiopia

Source: Google Maps, <https://maps.google.com/> (accessed May 14, 2014).

In France one can drive quickly and easily from any population center to any other. In Ethiopia, all roads lead to Addis Ababa. This centralization reduces the ability of the population to interact with each other, allowing the powerful central government to dominate transportation and trade. Any other roads that exist within Ethiopia and throughout most of Africa haven't seen much improvement since the late 1800s. Even these were primarily resource driven, as most went directly from the mines to the port, and provided no economic benefit to the indigenous people (Chido 2000).

How can the mission be completed as a strategic operation within the framework of Army Doctrine? The key component of all stability operations are legitimacy, host-nation ownership, and building partner capacity (ADP 3-07, 4). This means that there must be a perception by specific audiences of the legality and rightness of this action, based upon the mandate, manner, consent, and expectation for the action. The way to

ensure this is through comprehensive inter-organizational activities that integrate the host nation government and stakeholders from the planning process through completion.

As a hedge against the fear that any road built by western powers or with western money be seen as a symbol of greed and evil, we can take a lesson from General Tso Chong-tang, who was given a mission by the Empress of the Tsing Dynasty to quell an Islamic uprising in between Sian and Singkiang. As he conquered a region, he would always build a standard size road, capable of fitting five trucks driving abreast. To protect the road from the local's vandalism, he planted along the route a triple row of willows, and declared them a monument to God. The natives were so convinced of the holy nature of the trees that the road remained unscathed, and the locals even came to pray by the trees in times of illness and strife (Tan 1945).

To ensure that the manner and expectation of infrastructure development is legal and right, it should be performed primarily by the host nation, with the support of the international community. It will then become less a question of what the world is doing for the host nation, but what the host nation is accomplishing for itself, with the support of its allies. The road itself will become a symbol of unity and national pride. This will in turn encourage the people to take care of the road.

Significant care must be taken in planning to understand the disruptive effects of building a road. There is a legitimate risk that building high speed ground lines of communication in areas of ethnic strife would enable warlords and gangs more freedom of maneuver. However, it would also enable security forces the same freedom, and the economic and social benefits would far outweigh the risk. In another example, the occupants of an area where the plan calls for a new bridge may oppose the new

infrastructure, especially if they have generationally made their livings running a ferry system across the same river that the new bridge will span. Considerations must be made to first discover who the winners and losers will be. Efforts must be made to expand the pool of winners, and lessen the burden taken on by the losers. With the purpose of a common defense, spurred by nationalism and unity, the Burma Road was completed in just over two years with the help of nearly a million local workers, drivers, and Soldiers (Tan 1945). This was done because the government communicated with the people, and they understood the common and legitimate purpose.

Ethiopia and Economic Development

In order to show the relationship between national roadways and economic prosperity, a simple analysis is done using data from the CIA World Factbook, accessed 24 April 2014. Four specific data sets were taken: National Population, Size of Country in square kilometers, total roadway length in kilometers (paved and unpaved) and Gross Domestic Product (purchasing power). Some nations and entities did not have data in all four sets and were thus excluded. For example, Greenland has a population that lives along the coastlines. Each population center is more or less cut off from the others without any roadways crossing the land in between. All travel is done by sea or by air. As Greenland is an anomaly, it was excluded from this data set. Most others excluded were tiny island nations or city-states, like the Vatican City, which also do not conform to the analysis of a major modern country. Two nations of specific interest, Sudan and South Sudan are not included as new data in each category has not been available since the civil war, split of the nation, and independence in July 2011. The end-state was 218 countries which were all re-ranked from 1-218 based upon their stats in each category.

In order to shrink the data set even more to provide a better understanding of like nations, all countries whose total area was less than 10,000 square kilometers. This further reduced the weight of anomalies like Hong Kong, which is relatively small, but has a massive economy based upon financials, banking, and trade. These nations were then re-ranked from 1-164. The final reduction of the list was based upon population, removing all nations that had less than 1 million citizens. The final list was re-ranked again and included 150 nations, all of which are over 10,000 square kilometers in area and have a population of over 1,000,000,000 people. This final list is located at the end of this study in Appendix A.

Guinea-Bissau rounds out the bottom of the list, with only 3455 kilometers of roadway and a GDP of just over \$2 billion. It ranks 128th in area with 36,125 sq km and 146th in population with just under 1.7 million people. The United States of America leads the list in total kilometers of roadway and GDP, dropping to third in total area and population. In a simple analysis of the 20 nations with the most roadways, all were in the top 34 in highest GDP, with Sweden as the outlier at 34, the next lowest being Pakistan at 26. South Korea, with an incredible \$15 million in GDP per kilometer of roadway was the only nation not in the top 20 in road km (#44) to break into the top 15 in GDP, a 93 percent correlation. Conversely, when we look at the bottom 35 nations on the list, all nations with less than 18,000 km of roadway, twenty one of these are in the bottom 35 of GDP, a 60 percent correlation. This shows us that without a large GDP, a nation cannot have an abundance of roadway, but some nations can still have a good economy without the roads. The three furthest outliers in this bottom 35 are Kuwait, Qatar, and the UAE. They are all in the bottom 25 percent of roadways, but the top 40 percent of GDP. This is

easily explained by understanding that the preponderance of these nations' wealth comes from a small population oil-based economy.

A more in depth analysis is done by dividing each data set against the other and looking for trends. 87 percent of nations fall within a range of \$500,000 to \$7.1 million in GDP per kilometer of roadway. This range represents the normal conditions for economic success where this study is concerned. The outliers on the high end of this range are Qatar, Kuwait, and the UAE, which we know are small oil-rich nations with their own coastlines; Taiwan, South Korea, and Israel which have high-skilled high-technology based export economies; Bangladesh, which employs a low-wage, high-output clothing and textile export economy; and Lebanon, another small coastal nation focused on banking and tourism. The outliers on the lower end of the range are Zimbabwe, which suffers under the strict authoritarian regime of Robert Mugabe who has ruined the economy enough that it now boasts 95 percent unemployment; the Central African Republic, Democratic Republic of the Congo, Somalia, Liberia, Zambia, Guinea, Namibia, Burundi, and Kenya are also underdeveloped nations in Africa who have mostly suffered from disease, famine, civil war, and ethnic strife over the last few decades; the last group are Mongolia and Kyrgyzstan. Mongolia is the most sparsely populated nation in the world and Kyrgyzstan has suffered from near-continuous political and ethnic strife since the collapse of the Soviet Union. Each of these nations has a very specific obstacle blocking it from normal economic stability, and any major infrastructure development or repair would likely be tantamount to finishing the paint job of a house that is currently on fire. Because of the myriad of additional factors that directly impact an economy, any mathematical formula that could prove the relationship of roadway

infrastructure to economic prosperity would have too many discrepancies. It is more productive to show anecdotal evidence as well as general trends.

Table 1. Ethiopia and the 30 Nations Closest in Size

NATION	Road KM	SQ KM	# PEOPLE	\$ GDP Purchasing	POP/SQ KM	GDP/POP	GDP/SQ KM	RoadKM/SQKM	RoadKM/POP	GDP/RoadKM
Madagascar	34476	587041	23201926	\$22,030,000,000.00	39.52	\$949.49	\$37,527.19	0.06	0.00149	\$638,995.24
Ukraine	169694	603550	44291413	\$337,400,000,000.00	73.38	\$7,617.73	\$559,025.76	0.28	0.00383	\$1,988,284.79
France	1028446	643801	66259012	\$2,273,000,000,000.00	102.92	\$34,304.77	\$3,530,594.08	1.60	0.01552	\$2,210,130.62
Afghanistan	42150	652230	31822848	\$45,300,000,000.00	48.79	\$1,423.51	\$69,454.03	0.06	0.00132	\$1,074,733.10
Burma	34377	676578	55746253	\$111,100,000,000.00	82.39	\$1,992.96	\$164,208.71	0.05	0.00062	\$3,231,811.97
Chile	77764	756102	17363894	\$335,400,000,000.00	22.97	\$19,315.94	\$443,590.94	0.10	0.00448	\$4,313,049.74
Turkey	385748	783562	81619392	\$1,167,000,000,000.00	104.16	\$14,298.07	\$1,489,352.47	0.49	0.00473	\$3,025,291.12
Pakistan	262256	796095	196174380	\$574,100,000,000.00	246.42	\$2,926.48	\$721,145.09	0.33	0.00134	\$2,189,082.42
Mozambique	30331	799380	24692144	\$28,150,000,000.00	30.89	\$1,140.04	\$35,214.79	0.04	0.00123	\$928,093.37
Venezuela	96155	912050	28868486	\$407,400,000,000.00	31.65	\$14,112.27	\$446,686.04	0.11	0.00333	\$4,236,909.16
Nigeria	193200	923768	177155754	\$478,500,000,000.00	191.78	\$2,701.01	\$517,987.20	0.21	0.00109	\$2,476,708.07
Tanzania	364131	947300	45652138	\$79,290,000,000.00	52.40	\$1,597.33	\$83,701.05	0.09	0.00174	\$916,944.21
Egypt	137430	1001450	8895099	\$551,400,000,000.00	86.77	\$6,345.58	\$550,601.63	0.14	0.00158	\$4,012,224.41
Mauritania	10628	1030700	3516806	\$8,204,000,000.00	3.41	\$2,332.80	\$7,959.64	0.01	0.00302	\$771,923.22
Bolivia	80488	1098381	10631486	\$58,340,000,000.00	9.68	\$5,487.47	\$53,104.87	0.07	0.00757	\$724,828.55
Ethiopia	44359	1104300	96633458	\$118,200,000,000.00	87.51	\$1,223.18	\$107,036.13	0.04	0.00046	\$2,664,622.74
Colombia	141374	1136310	46245297	\$526,500,000,000.00	40.60	\$11,384.94	\$462,284.11	0.12	0.00306	\$3,724,164.27
South Africa	364131	1219090	48375645	\$595,700,000,000.00	39.68	\$12,314.05	\$488,643.17	0.30	0.00753	\$1,635,949.70
Mali	22174	1240192	14455903	\$18,900,000,000.00	13.27	\$1,148.52	\$15,239.58	0.02	0.00137	\$840,971.79
Angola	27423	1246700	15633106	\$131,800,000,000.00	15.31	\$6,904.82	\$105,719.10	0.04	0.00269	\$2,562,756.42
Niger	18949	1267000	17466172	\$13,980,000,000.00	13.79	\$800.40	\$11,033.94	0.01	0.00108	\$737,769.80
Chad	40000	1284000	11412107	\$28,000,000,000.00	8.89	\$2,453.53	\$21,806.85	0.03	0.00351	\$700,000.00
Peru	140672	1285216	30147935	\$344,000,000,000.00	23.46	\$11,410.40	\$267,659.29	0.11	0.00467	\$2,445,404.91
Iran	198866	1648195	80840713	\$987,100,000,000.00	49.05	\$12,210.43	\$598,897.58	0.12	0.00246	\$4,963,643.86
Libya	100024	1759540	6244174	\$73,600,000,000.00	3.55	\$11,786.99	\$41,829.11	0.06	0.01602	\$735,823.40
Indonesia	496607	1904569	253609643	\$1,285,000,000,000.00	133.16	\$5,066.84	\$674,693.33	0.26	0.00196	\$2,587,559.18
Mexico	377660	1964375	120286655	\$1,845,000,000,000.00	61.23	\$15,338.36	\$939,230.03	0.19	0.00314	\$4,885,346.61
Saudi Arabia	221372	2149690	27345986	\$927,800,000,000.00	12.72	\$33,928.20	\$431,597.11	0.10	0.00810	\$4,191,135.28
Algeria	113655	2381741	38813722	\$284,700,000,000.00	16.30	\$7,335.03	\$119,534.41	0.05	0.00293	\$2,504,949.19
Kazakhstan	97418	2724900	17948816	\$243,600,000,000.00	6.59	\$13,571.93	\$89,397.78	0.04	0.00543	\$2,500,564.58
Argentina	231374	2780400	43024374	\$771,000,000,000.00	15.47	\$17,920.07	\$277,298.23	0.08	0.00538	\$3,332,267.24

Source: Created by author. Data from Central Intelligence Agency,” CIA World Factbook,” <https://www.cia.gov/library/publications/the-world-factbook/rankorder/rankorderguide.html> (accessed April 23, 2014).

To target Ethiopia more specifically and understand how it compares to similar nations, first we look at the nations that are similar in size, including the fifteen that are both larger and smaller. Ethiopia ranks 6/31 on population density, but 26/31 for GDP per

population. The country is 19/31 on GDP per square kilometer, with an upward trending rank of 11/31 on GDP per road kilometer.

Table 2. Comparing Ethiopia's Population Density

NATION	Road KM	SQ KM	# PEOPLE	\$ GDP Purchasing	POP/SQ KM	GDP/POP	GDP/SQ KM	RoadKM/SQKM	RoadKM/POP	GDP/RoadKM
Mauritania	10628	1030700	3516806	\$8,204,000,000.00	3.41	\$2,332.30	\$7,959.64	0.01	0.00302	\$771,923.22
Libya	100024	1759540	6244174	\$73,600,000,000.00	3.55	\$11,786.99	\$41,829.11	0.06	0.01602	\$735,823.40
Kazakhstan	97418	2724900	17948816	\$243,600,000,000.00	6.59	\$13,571.93	\$89,397.78	0.04	0.00543	\$2,500,564.58
Chad	40000	1284000	11412107	\$28,000,000,000.00	8.89	\$2,453.53	\$21,806.85	0.03	0.00351	\$700,000.00
Bolivia	80488	1098581	10631486	\$58,340,000,000.00	9.66	\$5,487.47	\$53,104.87	0.07	0.00757	\$724,828.55
Saudi Arabia	221372	2149690	27345986	\$927,800,000,000.00	12.72	\$33,928.20	\$431,597.11	0.10	0.00810	\$4,191,135.28
Mali	22474	1240192	16455903	\$18,900,000,000.00	13.27	\$1,148.52	\$15,239.58	0.02	0.00137	\$840,971.79
Niger	18949	1267000	17466172	\$13,980,000,000.00	13.75	\$800.40	\$11,033.94	0.01	0.00108	\$737,769.80
Angola	51429	1246700	19088106	\$131,800,000,000.00	15.31	\$6,904.82	\$105,719.10	0.04	0.00269	\$2,562,756.42
Argentina	231374	2780400	43024374	\$771,000,000,000.00	15.47	\$17,920.07	\$277,298.23	0.08	0.00538	\$3,332,267.24
Algeria	113653	2381741	38813722	\$284,700,000,000.00	16.30	\$7,335.03	\$119,534.41	0.05	0.00293	\$2,504,949.19
Chile	77764	756102	17363894	\$335,400,000,000.00	22.97	\$19,315.94	\$443,590.94	0.10	0.00448	\$4,313,049.74
Peru	140672	1285216	30147935	\$344,000,000,000.00	23.46	\$11,410.40	\$267,659.29	0.11	0.00467	\$2,445,404.91
Mozambique	30331	799380	24692144	\$28,150,000,000.00	30.85	\$1,140.04	\$35,214.79	0.04	0.00123	\$928,093.37
Venezuela	96155	912050	28868486	\$407,400,000,000.00	31.65	\$14,112.27	\$446,686.04	0.11	0.00333	\$4,236,909.16
Madagascar	34476	587041	23201926	\$22,030,000,000.00	39.52	\$949.49	\$37,527.19	0.06	0.00149	\$638,995.24
South Africa	364131	1219090	48375645	\$595,700,000,000.00	39.66	\$12,314.05	\$488,643.17	0.30	0.00753	\$1,635,949.70
Colombia	141374	1138910	46245297	\$526,500,000,000.00	40.60	\$11,384.94	\$462,284.11	0.12	0.00306	\$3,724,164.27
Afghanistan	42150	652230	31822848	\$45,300,000,000.00	48.75	\$1,423.51	\$69,454.03	0.06	0.00132	\$1,074,733.16
Iran	198866	1648195	80840713	\$987,100,000,000.00	49.05	\$12,210.43	\$598,897.58	0.12	0.00246	\$4,963,643.86
Tanzania	86472	947300	49639138	\$79,290,000,000.00	52.40	\$1,597.33	\$83,701.05	0.09	0.00174	\$916,944.21
Mexico	377660	1964375	120286655	\$1,845,000,000,000.00	61.23	\$15,338.36	\$939,230.03	0.19	0.00314	\$4,885,346.61
Ukraine	169694	603550	44291413	\$337,400,000,000.00	73.38	\$7,617.73	\$559,025.76	0.28	0.00383	\$1,988,284.79
Burma	34377	676578	55746253	\$111,100,000,000.00	82.35	\$1,992.96	\$164,208.71	0.05	0.00062	\$3,231,811.97
Egypt	137430	1001450	86895099	\$551,400,000,000.00	86.77	\$6,345.58	\$550,601.63	0.14	0.00158	\$4,032,224.41
Ethiopia	44359	1104300	96633458	\$118,200,000,000.00	87.51	\$1,223.18	\$107,036.13	0.04	0.00046	\$2,664,622.74
France	1028446	643801	66259012	\$2,273,000,000,000.00	102.92	\$34,304.77	\$3,530,594.08	1.60	0.01552	\$2,230,130.62
Turkey	385748	783562	81619392	\$1,167,000,000,000.00	104.16	\$14,298.07	\$1,489,352.47	0.49	0.00473	\$3,025,291.12
Indonesia	496607	1904569	233609643	\$1,285,000,000,000.00	133.16	\$5,066.84	\$674,693.33	0.26	0.00196	\$2,587,559.18
Nigeria	193200	923768	177155754	\$478,500,000,000.00	191.78	\$2,701.01	\$517,987.20	0.21	0.00109	\$2,476,708.07
Pakistan	262256	796095	196174380	\$574,100,000,000.00	246.42	\$2,926.48	\$721,145.09	0.33	0.00134	\$2,189,082.42

Source: Created by author. Data from Central Intelligence Agency,” CIA World Factbook,” <https://www.cia.gov/library/publications/the-world-factbook/rankorder/rankorderguide.html> (accessed April 23, 2014).

Concerning infrastructure, Ethiopia is ranked 25/31 for length of road per square mile, and dead last, 31/31 for amount of roadway per population among comparatively sized nations. This amount of roadway by distance in a nation divided by the number of people who live in that nation will be called the Human Transportation Availability

Factor (HTAF) for the purposes of this study. This data set trend analysis proves that Ethiopia, in comparison to other nations of similar size, does not have enough roads to support its population or grow its economy. The nation has enough people to provide an ample workforce for an economy, and there is clearly opportunity to grow the economy. Among the 150 nations analyzed for this study, Ethiopia has the fifth lowest HTAF.

Table 3. Comparing Ethiopia's Human Transportation Availability Factor

NATION	Road KM	SQ KM	# PEOPLE	\$ GDP Purchasing	POP/SQ KM	GDP/POP	GDP/SQ KM	RoadKM/SQKM	RoadKM/POP	GDP/RoadKM
Ethiopia	44359	1104300	96633458	\$118,200,000,000.00	87.51	\$1,223.18	\$107,036.13	0.04	0.00046	\$2,664,622.74
Burma	34377	676578	55746253	\$111,100,000,000.00	82.39	\$1,992.96	\$164,208.71	0.05	0.00062	\$3,231,811.97
Niger	18949	1267000	17466172	\$13,980,000,000.00	13.79	\$800.40	\$11,033.94	0.01	0.00102	\$737,769.80
Nigeria	193200	923768	177155754	\$478,500,000,000.00	191.78	\$2,701.01	\$517,987.20	0.12	0.00109	\$2,476,708.07
Mozambique	30331	799380	24692144	\$28,150,000,000.00	30.89	\$1,140.04	\$35,214.79	0.04	0.00123	\$928,093.37
Afghanistan	42150	652230	31822848	\$45,300,000,000.00	48.79	\$1,423.51	\$69,454.03	0.06	0.00132	\$1,074,733.10
Pakistan	262256	796095	196174380	\$574,100,000,000.00	246.42	\$2,926.48	\$721,145.09	0.33	0.00134	\$2,189,082.42
Mali	22474	1240192	16455903	\$18,900,000,000.00	13.27	\$1,148.52	\$15,239.58	0.02	0.00137	\$840,971.79
Madagascar	34476	587041	23201926	\$22,030,000,000.00	39.52	\$949.49	\$37,527.19	0.06	0.00149	\$638,995.24
Egypt	137430	1001450	86895099	\$551,400,000,000.00	86.77	\$6,345.58	\$550,601.63	0.14	0.00158	\$4,012,224.41
Tanzania	86472	947300	49639138	\$79,290,000,000.00	52.40	\$1,597.33	\$83,701.05	0.09	0.00174	\$916,944.21
Indonesia	496607	1904569	253609643	\$1,285,000,000,000.00	133.16	\$5,066.84	\$674,693.33	0.26	0.00196	\$2,587,559.18
Iran	198866	1648195	80840713	\$987,100,000,000.00	49.05	\$12,210.43	\$598,897.58	0.12	0.00246	\$4,963,643.86
Angola	51429	1246700	19088106	\$131,800,000,000.00	15.31	\$6,904.82	\$105,719.10	0.04	0.00269	\$2,562,756.42
Algeria	113655	2381741	38813722	\$284,700,000,000.00	16.30	\$7,335.03	\$119,534.41	0.05	0.00293	\$2,504,949.19
Mauritania	10628	1030700	3516806	\$8,204,000,000.00	3.41	\$2,332.80	\$7,959.64	0.01	0.00302	\$771,923.22
Colombia	141374	1138910	46245297	\$526,500,000,000.00	40.60	\$11,384.94	\$462,284.11	0.12	0.00306	\$3,724,164.27
Mexico	377660	1964375	120286655	\$1,845,000,000,000.00	61.23	\$15,338.36	\$939,230.03	0.19	0.00314	\$4,885,346.61
Venezuela	96155	912050	28868486	\$407,400,000,000.00	31.65	\$14,112.27	\$446,686.04	0.11	0.00333	\$4,236,909.16
Chad	40000	1284000	11412107	\$28,000,000,000.00	8.89	\$2,453.53	\$21,806.85	0.03	0.00351	\$700,000.00
Ukraine	169694	603550	44291413	\$337,400,000,000.00	73.38	\$7,617.73	\$559,025.76	0.28	0.00383	\$1,988,284.79
Chile	77764	756102	17363894	\$335,400,000,000.00	22.97	\$19,315.94	\$443,590.94	0.10	0.00448	\$4,313,049.74
Peru	140672	1285216	30147935	\$344,000,000,000.00	23.46	\$11,410.40	\$267,659.29	0.11	0.00467	\$2,445,404.91
Turkey	385748	783562	81619392	\$1,167,000,000,000.00	104.16	\$14,298.07	\$1,489,352.47	0.49	0.00473	\$3,025,291.12
Argentina	231374	2780400	43024374	\$771,000,000,000.00	15.47	\$17,920.07	\$277,298.23	0.08	0.00538	\$3,332,267.24
Kazakhstan	97418	2724900	17948816	\$243,600,000,000.00	6.59	\$13,571.93	\$89,397.78	0.04	0.00543	\$2,500,564.58
South Africa	364131	1219090	48375645	\$595,700,000,000.00	39.68	\$12,314.05	\$488,643.17	0.30	0.00753	\$1,635,949.70
Bolivia	80488	1098581	10631486	\$58,340,000,000.00	9.68	\$5,487.47	\$53,104.87	0.07	0.00757	\$724,828.55
Saudi Arabia	221372	2149690	27345986	\$927,800,000,000.00	12.72	\$33,928.20	\$431,597.11	0.10	0.00810	\$4,191,135.28
France	1028446	643801	66259012	\$2,273,000,000,000.00	102.92	\$34,304.77	\$3,530,594.08	1.60	0.01552	\$2,210,130.62
Libya	100024	1759540	6244174	\$73,600,000,000.00	3.55	\$11,786.99	\$41,829.11	0.06	0.01602	\$735,823.40

Source: Created by author. Data from Central Intelligence Agency,” CIA World Factbook,” <https://www.cia.gov/library/publications/the-world-factbook/rankorder/rankorderguide.html> (accessed April 23, 2014).

The nations compared in this first step of the analysis fell fairly evenly across the board. The issue clearly has more to do with a nation's population density than it does with the overall size of the nation. The next logical step in the trend analysis is to compare Ethiopia's numbers to other nations of similar population density. A smaller group, 20 nations in all was selected for this analysis.

Table 4. Ethiopia Compared to Nations of Similar Population Density

NATION	ROAD RANK	Road KM	AREA RANK	SQ KM	POP RANK	# PEOPLE	ECON RANK	\$ GDP Purchasing Power	Population Density	GDP per capita	Road Per Capita
Kenya	30	160878	46	580367	30	45010056	78	\$79,900,000,000.00	77.554472	\$1,775.16	0.003574
Croatia	97	29410	119	56594	121	4470534	80	\$78,900,000,000.00	78.993073	\$17,648.90	0.006579
Sierra Leone	128	11300	112	71740	108	5743725	138	\$9,156,000,000.00	80.063075	\$1,594.09	0.001967
Timor-Leste	142	6040	144	14874	150	1201542	117	\$25,410,000,000.00	80.781363	\$21,147.83	0.005027
Macedonia	123	14038	138	25713	141	2091719	119	\$22,570,000,000.00	81.348695	\$10,790.17	0.006711
Greece	40	116960	91	131957	78	10775557	48	\$267,100,000,000.00	81.659609	\$24,787.58	0.010854
Swaziland	149	3594	143	17364	148	1419623	142	\$6,259,000,000.00	81.75668	\$4,408.92	0.002532
Burma	93	34377	38	676578	24	55746253	68	\$111,100,000,000.00	82.394422	\$1,992.96	0.000617
Cambodia	88	39618	85	181035	67	15458332	101	\$39,640,000,000.00	85.388628	\$2,564.31	0.002563
Egypt	37	137430	28	1001450	15	86895099	27	\$551,400,000,000.00	86.709284	\$6,345.58	0.001582
Ethiopia	79	44359	25	1104300	13	96633458	66	\$118,200,000,000.00	87.506527	\$1,223.18	0.000459
Jordan	137	7203	105	89342	95	7930491	99	\$40,020,000,000.00	88.765541	\$5,046.35	0.000908
Benin	118	16000	96	112622	85	10160556	129	\$16,650,000,000.00	90.218217	\$1,638.69	0.001575
Romania	56	84185	79	238391	56	21729871	45	\$280,700,000,000.00	91.152229	\$12,917.70	0.003874
Malaysia	33	144403	64	329847	42	30073353	29	\$525,000,000,000.00	91.173644	\$17,457.32	0.004802
Costa Rica	90	39018	121	51100	119	4755234	87	\$61,430,000,000.00	93.057417	\$12,918.40	0.008205
Serbia	81	44248	110	77474	98	7209764	77	\$80,470,000,000.00	93.060433	\$11,161.25	0.006137
Spain	10	683175	49	505370	28	47737941	14	\$1,389,000,000,000.00	94.461367	\$29,096.35	0.014311
Syria	68	69873	84	185180	59	17951639	70	\$107,600,000,000.00	96.941565	\$5,993.88	0.003892
Austria	39	124508	107	83871	92	8223062	36	\$561,000,000,000.00	98.044163	\$43,900.92	0.015141

Source: Created by author. Data from Central Intelligence Agency," CIA World Factbook," <https://www.cia.gov/library/publications/the-world-factbook/rankorder/rankorderguide.html> (accessed April 23, 2014).

Table 5. Ethiopia Compared by GDP per Capita

NATION	ROAD RANK	Road KM	AREA RANK	SQ KM	POP RANK	# PEOPLE	ECON RANK	\$ GDP Purchasing Power	Population Density	GDP per capita	Road Per Capita
Ethiopia	79	44359	25	1104300	13	96633458	66	\$118,200,000,000.00	87.506527	\$1,223.18	0.000459
Sierra Leone	128	11300	112	71740	108	5743725	138	\$9,156,000,000.00	80.063075	\$1,594.09	0.001967
Benin	118	16000	96	112622	85	10160556	129	\$16,650,000,000.00	90.218217	\$1,638.69	0.001575
Kenya	30	160878	46	580367	30	45010056	78	\$79,900,000,000.00	77.554472	\$1,775.16	0.003574
Burma	93	34377	38	676578	24	55746253	68	\$111,100,000,000.00	82.394422	\$1,992.96	0.000617
Cambodia	88	39618	85	181035	67	15458332	101	\$39,640,000,000.00	85.388638	\$2,564.31	0.002563
Swaziland	149	3594	143	17364	148	1419623	142	\$6,259,000,000.00	81.75668	\$4,408.92	0.002532
Jordan	137	7203	105	89342	95	7930491	99	\$40,020,000,000.00	88.765541	\$5,046.35	0.000908
Syria	68	69873	84	185180	59	17951639	70	\$107,600,000,000.00	96.941565	\$5,993.88	0.003892
Egypt	37	137430	28	1001450	15	86895099	27	\$551,400,000,000.00	86.769284	\$6,345.58	0.001582
Macedonia	123	14038	138	25713	141	2091719	119	\$22,570,000,000.00	81.348695	\$10,790.17	0.006711
Serbia	81	44248	110	77474	98	7209764	77	\$80,470,000,000.00	93.060433	\$11,161.25	0.006137
Romania	56	84185	79	238391	56	21729871	45	\$280,700,000,000.00	91.152229	\$12,917.70	0.003874
Costa Rica	90	39018	121	51100	119	4755234	87	\$61,430,000,000.00	93.057417	\$12,918.40	0.008205
Malaysia	33	144403	64	329847	42	30073353	29	\$525,000,000,000.00	91.173644	\$17,457.32	0.004802
Croatia	97	29410	119	56594	121	4470534	80	\$78,900,000,000.00	78.993073	\$17,648.90	0.006579
Timor-Leste	142	6040	144	14874	150	1201542	117	\$25,410,000,000.00	80.781363	\$21,147.83	0.005027
Greece	40	116960	91	131957	78	10775557	48	\$267,100,000,000.00	81.659609	\$24,787.58	0.010854
Spain	10	683175	49	505370	28	47737941	14	\$1,389,000,000,000.00	94.461367	\$29,096.35	0.014311
Austria	39	124508	107	83871	92	8223062	36	\$361,000,000,000.00	98.044163	\$43,900.92	0.015141

Source: Created by author. Data from Central Intelligence Agency,” CIA World Factbook,” <https://www.cia.gov/library/publications/the-world-factbook/rankorder/rankorderguide.html> (accessed April 23, 2014).

Table 6. Ethiopia Compared by Human Transportation Availability Factor

NATION	ROAD RANK	Road KM	AREA RANK	SQ KM	POP RANK	# PEOPLE	ECON RANK	\$ GDP Purchasing Power	Population Density	GDP per capita	Road Per Capita
Ethiopia	79	44359	25	1104300	13	96633458	66	\$118,200,000,000.00	87.506527	\$1,223.18	0.000459
Burma	93	34377	38	676578	24	55746253	68	\$111,100,000,000.00	82.394422	\$1,992.96	0.000617
Jordan	137	7203	105	89342	95	7930491	99	\$40,020,000,000.00	88.765541	\$5,046.35	0.000908
Benin	118	16000	96	112622	85	10160556	129	\$16,650,000,000.00	90.218217	\$1,638.69	0.001575
Egypt	37	137430	28	1001450	15	86895099	27	\$551,400,000,000.00	86.769284	\$6,345.58	0.001582
Sierra Leone	128	11300	112	71740	108	5743725	138	\$9,156,000,000.00	80.063075	\$1,594.09	0.001967
Swaziland	149	3594	143	17364	148	1419623	142	\$6,259,000,000.00	81.75668	\$4,408.92	0.002532
Cambodia	88	39618	85	181035	67	15458332	101	\$39,640,000,000.00	85.388638	\$2,564.31	0.002563
Kenya	30	160878	46	580367	30	45010056	78	\$79,900,000,000.00	77.554472	\$1,775.16	0.003574
Romania	56	84185	79	238391	56	21729871	45	\$280,700,000,000.00	91.152229	\$12,917.70	0.003874
Syria	68	69873	84	185180	59	17951639	70	\$107,600,000,000.00	96.941565	\$5,993.88	0.003892
Malaysia	33	144403	64	329847	42	30073353	29	\$525,000,000,000.00	91.173644	\$17,457.32	0.004802
Timor-Leste	142	6040	144	14874	150	1201542	117	\$25,410,000,000.00	80.781363	\$21,147.83	0.005027
Serbia	81	44248	110	77474	98	7209764	77	\$80,470,000,000.00	93.060433	\$11,161.25	0.006137
Croatia	97	29410	119	56594	121	4470534	80	\$78,900,000,000.00	78.993073	\$17,648.90	0.006579
Macedonia	123	14038	138	25713	141	2091719	119	\$22,570,000,000.00	81.348695	\$10,790.17	0.006711
Costa Rica	90	39018	121	51100	119	4755234	87	\$61,430,000,000.00	93.057417	\$12,918.40	0.008205
Greece	40	116960	91	131957	78	10775557	48	\$267,100,000,000.00	81.659609	\$24,787.58	0.010854
Spain	10	683175	49	505370	28	47737941	14	\$1,389,000,000,000.00	94.461367	\$29,096.35	0.014311
Austria	39	124508	107	83871	92	8223062	36	\$361,000,000,000.00	98.044163	\$43,900.92	0.015141

Source: Created by author. Data from Central Intelligence Agency,” CIA World Factbook,” <https://www.cia.gov/library/publications/the-world-factbook/rankorder/rankorderguide.html> (accessed April 23, 2014).

These tables clearly show that when Ethiopia is compared to nations of similar population density, its people have far less wealth than those in other countries. Additionally, the people of Ethiopia suffer from a severe lack of access to roadways and the ability to transport and market goods. While the correlation of these two significant societal factors can not be definitively linked, it can not be overlooked, as common sense tells us that specifically in a landlocked nation, the two elements are clearly intertwined. Ethiopia's economy suffers from a lack of roads.

Strategy

Strategy in foreign relations is a carefully weighted decision making framework constructed within the threats, challenges, and opportunities existing within nations, regions, and geopolitical environments. What the United States must do to successfully execute foreign policy is correctly identify the best opportunities within which the risks posed by threat are manageable and the challenges of performing the action are surmountable. A case such as Ethiopia provides a significant opportunity with a minimal threat environment comparatively considering the region. While there are challenges, primarily funding and scope, these are also just veiled opportunities. It may take a massive undertaking to create a highways system capable of changing the economic landscape within a nation that is two and half times the size of Texas. Though it may be a project of such scope that it would rival the building of the Great Wall of China, it provides the opportunity to create a lasting testament to American Industrialism, exceptionalism, and largesse, a monument to economic freedom. Funding could as well be seen as a challenge, but it is as well an opportunity for nations, international

organizations, charities, and NGOs to work in concert with each other toward the noble undertaking of providing a bright and enduring future for an entire people.

Within the framework of the instruments of national power, a major infrastructure development in Ethiopia is far more than an opportunity to get bragging rights for creating one of the wonders of the modern industrial world. It meets elements of the three core elements of the NSS line of effort promoting dignity by meeting basic needs. The three that are detailed, health, food security, and humanitarian crisis are all supported by transportation infrastructure development. Creating a high-speed, high-efficiency ground line of communication throughout the country, dispersion of medicine and healthcare will be cheaper and easier, transportation of crops and livestock will enable a thriving agricultural market, and aid can rapidly be deployed from the ports at Djibouti and Berbera to needy displaced persons and refugees in eastern Ethiopia, Kenya, Sudan, and South Sudan.

Strategic Policy-makers and those who execute our foreign policy will analyze both regions and nations to best understand what those areas need for their own good and how we can operate within those areas in ways that support our national interests. Current strategic trends highlight a “new realism” which assumes that our national interest is indeed global interest. The objective is rooted in the idea of providing security through having as many actors as possible achieve their positive goals, with none at the expense of the others (Sandole 2010). The idea is to create as many win-win enterprises as possible. Ethiopia, as a nation, historically understands this idea. Their work with peacekeepers in Somalia in the 1990s was not primarily benevolent, but because of ties

with the UN and the United States who urged them to help, as well as for the sake of their own regional stability in the horn of Africa (McQueen 2011).

We know that a modern highway infrastructure within Ethiopia would increase the government's capability to provide services to its people as well as help the nation's economy. The ability to provide services is apparent, any increase in mobility would enable government entities quicker and easier access to remote areas. Less immediately apparent is that an increase in mobility will help the economy as well. The lack of infrastructure in African nations is incredibly limiting to the economy, according to a 2008 World bank study, diminishing business productivity by 40 percent (Chido 2011).

These two statistics, population density and HTAF, when taken together tell us that nations like Ethiopia, who do not have the highway infrastructure to take advantage of the large workforce, will suffer economically due to that capability gap. China, the world's largest growing economy after the United States is investing \$767 billion to double the size of their current transportation infrastructure by 2030, according to China Daily, the state-run media website. According to Bloomberg, The next largest growing economy, India, plans to spend up to one trillion dollars on transportation infrastructure by 2017. These nations understand that to continue growing their economies, this level of investment in transportation infrastructure is absolutely essential. This fact has been known about Africa for over 100 years. King Leopold of Belgium pointed out that without transportation infrastructure, the only way to get any riches that there are within the Congo, would be to carry them out on foot (Chido 2011).

Current aid to Ethiopia from the United States, according to USAID, was \$519 million in 2013. None of that money was spent on infrastructure. As far back as 2006, no

aid money to Ethiopia has been spent on developing the infrastructure. The Ethiopian government is trying to help itself in this sector and hired a Chinese contractor to build a highway connecting Addis Ababa to Adama, a smaller city eighty kilometers from the capital. According to roadtraffic-technology.com, this will be the first expressway in east Africa when complete and will come with a price tag of \$612 million.

At \$7.65 million per kilometer, this will be an extremely expensive project, costing far more than Ethiopia could afford on its own. \$350 million for the project is a soft loan from the import-export bank of China, which according to China's People's Daily Online news website, is directed at contributing to the economic development of Ethiopia. It stands to reason that if the United States wants to benefit economically from the emerging markets in Africa, then we should follow China's lead and truly invest in the economy by helping develop the infrastructure that supports it. To improve the economic conditions for the people, we can even capitalize on the new infrastructure that China is building, which follows the old models of accessing mineral and oil resources from the ports (Chido 2011). Smaller connecting roads could be constructed off of these main arteries, thereby providing access to the populace. Additionally, if built by the military and host nation workers instead of Chinese contractors, the growth of skills and abilities, as well as the direct economic impact of job creation would be immediately beneficial.

Strategic highway construction can get bogged down during a conflict for myriad reasons. The Ledo Road, constructed in the Pacific theatre during WWII, consistently lost out on manpower requirements to the D-Day Invasion in the European theatre in 1944 (Anders 1965). The Chinese government decided to fight against Japanese aggression and

in order to survive; they needed the ability to transit inland. Just like rural China, there are many different ethnic groups with different languages and traditions in Ethiopia and many other places where roads are scarce. The availability of skilled labor is likewise very low. Similar elements also exist in the problems arising from terrain and cross-border partnerships and negotiations to ensure a trans-nation project would succeed.

The Burma Road was built out of necessity. The Ledo road was constructed because it was clearly a better transportation alternative to air, as seen in August 1944 when 10,564 tons of supplies went over the one-lane unimproved road into Burma, compared to the 10,080 tons that went by air, which was a far more established method of conveyance at the time. The road was originally planned as a two lane highway, which would have increased the tonnage capability dramatically, even though General Pick claimed of his current one lane road that it handled “all the traffic I could put on it” (Anders 1965). The major problem of trying to complete a large-scale project during a war is the endless hands in the pie that consistently change and redirect the project into finally resembling barely a shade of that which was originally envisioned (Anders 1965). Clearly it would have been better for the Allied war effort against Imperial Japan if a major strategic highway already existed at the start of the conflict. It would have enabled a quicker fielding of supplies, cost far less to build, and reduced the burden of personnel, transportation assets, and equipment during a time when those assets could be put to better use to fight the enemy.

Donald Rumsfeld, the former US Secretary of Defense, famously said during a press conference in 2004 “you go to war with the army you have, not the army you might want or wish to have.” It could as easily be said, that you go to war wherever the war is,

not where you might want or wish to have a war. Army engineers at the tactical level shape the battlefield with obstacles to block, turn, fix and disrupt the enemy force. They also plan to reduce enemy obstacles and provide the friendly force with assured mobility. US Army Engineers at the strategic level can look to future areas of operations and shape that battlefield to set the conditions for successful combined arms maneuver and wide area security through line of communication and infrastructure development.

A major strategic highway development project executed during Phase 0 would mitigate the effects of terrain and provide freedom of action for land power. This type of project is perfectly suited to the US Army Engineer Regiment. The articulated purpose and activities of Army Engineers are to help ground force commanders assure mobility, enhance protection, enable force projection and logistics, build partner capacity and develop infrastructure among populations and nations (Department of the Army 2013c). By working with the host-nation military, the US Army can teach them how to properly construct modern roads and work alongside their troops to create the new infrastructure. This would significantly build the capacity of the host nation's professional army while creating the infrastructure necessary for the population to thrive in a free market economy and for the government to provide services to the people. Additionally, it provides a ground line of communication to enable logistics and project forces to the continent's interior in the case of future contingency operations.

Understanding that part of our foreign policy and national strategic approach is to pursue comprehensive engagement with nations, institutions, and peoples around the world, building roads is both literally and figuratively important. The 2010 US National Security Strategy repeatedly highlights that the United States' greatest strength is the

people who believe in the universal values and human rights that we want the rest of the world to realize and adhere to. The African Continent is home to many oppressive regimes, and is littered with corrupt government entities. Human rights are going to continue to be an issue wherever development is occurring. In 1776, the United States declared its independence by stating self evident truths, including that all men are created equal, with the rights to life liberty and the pursuit of happiness. However, it wasn't until almost 90 years later that slavery was abolished, followed by another 100 years of segregation and Jim Crow laws. Almost 200 years after independence and declaring equal rights to all men, the United States was still guilty of what are considered today human rights abuses.

Most nations in Africa, like China, have only achieved their current Independence in the last 70 years since World War II. In 1994, President Clinton made the decision to continue China's most favored nation status even though he campaigned against ending it because of China's human rights abuses. Executive pragmatism drove him to understand that isolating China would not help the rights of oppressed individuals, and that much more could be done through engagement (Bolton 2000). Individual human dignity and right to liberty is a relatively new idea in world history. We would do well to understand that change will come in excruciating increments, and will likely only occur through positive engagement and building inroads with people of all nations on a personal basis. Problematic for this approach is that it lays in a polar opposite direction of the US Government's January 2012 Defense Strategic Guidance, which states:

Building partnership capacity elsewhere in the world also remains important for sharing the costs and responsibilities of global leadership. Across the globe we will seek to be the security partner of choice, pursuing new partnerships with a

growing number of nations including those in Africa and Latin America whose interests and viewpoints are merging into a common vision of freedom, stability, and prosperity. Whenever possible, we will develop innovative, low-cost, and small-footprint approaches to achieve our security objectives, relying on exercises, rotational presence, and advisory capabilities.

While clearly not the low cost option, a major highway infrastructure project would enable this interest. It provides not just the opportunity for an American or NATO delegation to work alongside the host-nation officials, but also provides increased access to the people. Daily interaction with people during the execution of the project will enable discourse and the spread of information and ideals. By working with officials in every sector of government, including the military, the host nation can develop institutionally and economically, while understanding the core values espoused in the National Security Strategy at a basic level. Instead of engaging in the expensive and historically unsuccessful anti-corruption campaigns of mandates and ultimatums on good governance, a delegation of noble individuals from governments, NGOs and industry can help the people, help the economy, befriend the government and sell these ideas and values on their own merits (Chido 2011).

Such a construction program would also have the benefit of providing the skills to build and maintain roads to the military officers and NCOs partnered with US forces. Once retired, these same individuals can carry these skills onto a successful second career in continuing the development and upkeep of the nation's infrastructure. Similar opportunities can be made for civil engineering, telecommunications, and computer science. This generational economic underpinning will stabilize the region by employing soldiers who know more than just soldiering. The opportunity to gain these skills will

increase the value of military service within these nations, improving discipline and loyalty within the armed forces (Chido 2011).

During the US war in Afghanistan, road development became a major line of operation consuming billions of dollars in aid during the first few years alone. The plan was to triple the road density from .15km per 1000 people to .46 in ten years (Melin 2011). One route, between Kandahar and Tarin Kowt was budgeted \$25 million for a paved two lane road. Between the Army Engineers and USAID contractors, most of the road was completed within a year, at a total cost of \$55 million (Melin 2011). The project then languished due to poor contracting process, changing priorities, and a deteriorating security situation (Melin 2011). This failure caused a de-legitimization of the American presence in the area. The lesson learned is that a project of this nature must have the understanding of the people and their input during the planning process. It must have adequate time and resources to drive directly from start to completion, and is much easier to conduct with trained and capable personnel in a secure environment.

Time will tell if the many billions spent on economic infrastructure development in Afghanistan will have the desired effect. However, we can look to similar projects by the British in Baluchistan and Waziristan in the 1930s. Roads and railways built in these regions had the desired effect of enabling access, contributing to the rise in profits for the Indian economy, and increasing tax revenue (Melin 2011). However, if the economy does not improve in line with the intent, it will likely be due more to the failure of legitimacy, than of the project itself. ADP 3-07, the Army's pamphlet on Stability Operations, spells out that legitimacy depends on:

the successful interplay of four factors: mandate, manner, consent, and expectation. Mandate is the perceived legitimacy of the mandate that establishes the authority of the host nation. This can result from universal suffrage, religious authority, or a recognized and accepted caste or tribal model. Manner is the perceived legitimacy in which those exercising the mandate conduct themselves, both individually and collectively. Consent is the extent to which factions, local populations, neighboring states, the international community and others consent to, comply with, or resist the authority of those exercising the mandate. Consent, or its absence, may range from active resistance to freely given support. Expectation is the extent to which those exercising the mandate manage or meet the expectations and aspirations of factions, local populations, and others. (Department of the Army 2013a)

If this legitimacy does not exist, the intended outcomes of any stability operation, including infrastructure development will be highly impacted. The likely benefits, both economically and for partnership will be diminished. The best way to ensure legitimacy is through a coalition approach with the blessing and support of intergovernmental organizations like the United Nations. Ethiopia supported the UN peacekeeping efforts in Somalia in the 1990s and received UN peacekeepers after its own civil war with Eritrea, forming an interposition force between 2000 and 2008 (MacQueen 2011). The UN Development Program in Ethiopia's Development Assistance Group (DAG) is co-chaired by USAID and World Bank Country Directors and is suited to be the best partner for any kind of bilateral foreign development projects. Through the DAG and UNDP, the system for combating corruption and evaluating project necessity is already in place. Planners can collaborate directly with these NGOs/IGOs and develop a plan of action in line with a comprehensive strategy for development, thus ensuring both legitimacy and mandate and manner of execution.

Summary

This analysis has shown that Ethiopia would certainly benefit from a major effort to develop internal roadway infrastructure. Primarily, the improvement would be economic, which many academics see as important to stability. However, the analysis shows that there are additional opportunities for increasing regional stability, such as aiding in the professionalization of host nation armed forces, and improved access for the government to provide services to the people. Most importantly, where the idea of a major project veers away from the low-cost strategy currently employed, it provides a more solid foundation for engagement and a far greater overall upside. There are many different ways to approach the financing and employment of the multinational assistance for such an endeavor, but as can be seen by China's unilateral development efforts in Africa, these developing nations are clearly amenable to inviting the world to help.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

This study affirmatively answers the question of whether the development of modern roadway infrastructure in developing nations is a prudent and feasible line of effort that supports the United States' National Interests. Providing populations access to the economy promotes dignity and self-worth as it increases the possibility for peoples to determine for themselves the quality of life that they desire. Highway infrastructure will improve developing economies by increasing exports and imports as resources become more accessible and markets begin to open. The government will benefit by gaining easier access to its people to provide essential services. This line of thought correlates directly with the United States National Security Strategy:

Where governments are incapable of meeting their citizens' basic needs and fulfilling their responsibilities to provide security within their borders, the consequences are often global and may directly threaten the American people. To advance our common security, we must address the underlying political and economic deficits that foster instability, enable radicalization and extremism, and ultimately undermine the ability of governments to manage threats within their borders and to be our partners in addressing common challenges. (The President of the United States 2010)

If the development project is planned, coordinated and executed within a whole-of-government approach, as access is improved, and the economy grows, so will good governance develop through positive engagement of American Soldiers and Diplomats with the host nation officials. Such engagement, based upon mutual trust with the underpinnings of values and basic human rights will succeed in developing an environment conducive to sustained progress and regional stability in the future.

The United States Military is an excellent conduit to developing nation's governments. The US Army's stability doctrine identifies the required necessity of legitimacy and building partner capacity as essential to ensuring successful development projects. Most host nation militaries in the developing world are undertrained in respect to civilian skill sets like engineering, construction, administration, and maintenance. The partnership between US military forces and those militaries in the developing world will provide not only these skills, but respect for hard work in the pursuit of helping the nation's citizens. A large road or highway, built by the military and the country's citizens can serve as a point of national pride as well as being a boon to the economy.

Globalization has made the world more interconnected than ever before. Unfortunately there are still many places where populations have suffered under the dark side of this globalization. The same technologies that enable telecommunications and free access to information have been used to suppress minority tribes and ethnic groups in nations with less developed infrastructure. Engagement with the government of developing nations is a means to changing perceptions and core values, not through intimidation or punishment, but through good example and progress.

Recommendations

The United States Army's new plan for Regionally Aligned Forces is based in the idea that American Soldiers and units will benefit from engagement with people of other cultures. The reverse is also true. President Obama outlined this fact when he stated in a speech at the National Archives on May 21, 2009:

We uphold our most cherished values not only because doing so is right, but because it strengthens our country and keeps us safe. Time and again, our values have been our best national security asset—in war and peace, in times of ease, and

in eras of upheaval. Fidelity to our values is the reason why the United States of America grew from a small string of colonies under the writ of an empire to the strongest nation in the world.

The United States Army should implement the training of host nation forces on infrastructure development and maintenance tasks as part of RAF deployments. Army Civil Affairs officers and engineer units can easily assist in planning and constructing these roads. National Geospatial Intelligence Agency assets as well as Army topographic engineers can assist in planning for the best locations and types of roads. By working side by side with the host nation security forces, they will learn how to perform this type of construction, maintain their equipment and maintain the roadways for future use.

Any highway and road construction should be planned to maximize the use of existing roads and planned roads, such as the 80 kilometer stretch of highway that China is helping Ethiopia to build. The road must be planned to connect the government, the people and the markets. This will allow for the greatest impact on economics and governance. The type of road should be one that can easily be maintained at low cost with basic equipment. While much of the work could be contracted, it is better for the construction to be done by the host nation military, trained to do it by the US Army. This allows opportunity for the engagement that we need, gives those forces usable skills, and creates a symbol of advancement that the nation can be proud of, instead of it just being a road that an international company came, built, and left.

Summary

The national interests of the United States are supported by the military engaging with host-nation forces in developing nations throughout the world in a joint venture to construct roads and highways that improve the transportation infrastructure of the region.

Both nations will benefit as American Soldiers learn about different cultures and host nation officials learn to understand American values. The US military will gain firsthand knowledge of the physical and human terrain of different regions as well as increasing the available mobility corridors for future operations in support of natural disaster response, humanitarian crises, or peacekeeping. This approach would certainly work well in Ethiopia, as evidenced by this study, but it has applicability throughout the world, in any place where the United States and coalition partners have an interest in stability.

Recommended Further Study

Recommended future study is the possibility of other lines of development, such as energy production, railway, and telecommunications. These were not specifically targeted here as the US military does not currently have the organic capability to construct them and train foreign armies on their construction and maintenance. Additional future study recommendations are additional plausibility probes for infrastructure development deployments into nations in Africa, Southeast Asia, and South America.

APPENDIX A

List of Nations' Size, Roadway distance, Population, GDP, and Population Density

All of the data in Appendix A is take from the Central Intelligence Agency's World Factbook. This data was specifically pulled from the country comparisons and includes: population, gross domestic product, roadway distance, and geographical area. Further analysis found in tables throughout this study are calculations performed by the author. The following pages in this appendix contain all of the raw data utilized in this study, which was accessed from The World Factbook's web page on April 23, 2014. The purpose for posting this raw data is to ensure the longevity of the solution. The data on the website is updated annually as the global environment continues to change.

NATION	Road KM	SQ KM	# PEOPLE	\$ GDP Purchasing	POP/SQ KM
Afghanistan	42150	652230	31822848	\$45,300,000,000.00	48.79
Albania	18000	28748	3020209	\$26,730,000,000.00	105.06
Algeria	113655	2381741	38813722	\$284,700,000,000.00	16.3
Angola	51429	1246700	19088106	\$131,800,000,000.00	15.31
Argentina	231374	2780400	43024374	\$771,000,000,000.00	15.47
Armenia	7705	29743	3060631	\$20,610,000,000.00	102.9
Australia	823217	7741220	22507617	\$998,300,000,000.00	2.91
Austria	124508	83871	8223062	\$361,000,000,000.00	98.04
Azerbaijan	52942	86600	9686210	\$100,400,000,000.00	111.85
Bangladesh	21269	143998	166280712	\$324,600,000,000.00	1154.74
Belarus	86392	207600	9608058	\$150,400,000,000.00	46.28
Belgium	154012	30528	10449361	\$421,700,000,000.00	342.29
Benin	16000	112622	10160556	\$16,650,000,000.00	90.22
Bolivia	80488	1098581	10631486	\$58,340,000,000.00	9.68
Bosnia and Herzegovina	22926	51197	3871643	\$32,160,000,000.00	75.62
Botswana	17916	581730	2155784	\$34,000,000,000.00	3.71
Brazil	1580964	8514877	202656788	\$2,422,000,000,000.00	23.8
Bulgaria	19512	110879	6924716	\$104,600,000,000.00	62.45
Burkina Faso	15272	274200	18365123	\$26,510,000,000.00	66.98
Burma	34377	676578	55746253	\$111,100,000,000.00	82.39
Burundi	12322	27830	10395931	\$5,750,000,000.00	373.55
Cambodia	39618	181035	15458332	\$39,640,000,000.00	85.39
Cameroon	51350	475440	23130708	\$53,160,000,000.00	48.65
Canada	1042300	9984670	34834841	\$1,518,000,000,000.00	3.49
Central African Republic	20278	622984	5277959	\$3,336,000,000.00	8.47
Chad	40000	1284000	11412107	\$28,000,000,000.00	8.89
Chile	77764	756102	17363894	\$335,400,000,000.00	22.97
China	4106387	9596961	1355692576	\$13,370,000,000,000.00	141.26
Colombia	141374	1138910	46245297	\$526,500,000,000.00	40.6
Congo, DR of the	153497	2344858	77433744	\$29,390,000,000.00	33.02
Congo, Republic of the	17289	342000	4662446	\$20,260,000,000.00	13.63
Costa Rica	39018	51100	4755234	\$61,430,000,000.00	93.06
Cote d'Ivoire	81996	322463	22848945	\$43,670,000,000.00	70.86
Croatia	29410	56594	4470534	\$78,900,000,000.00	78.99
Cuba	60858	110860	11047251	\$121,000,000,000.00	99.65
Czech Republic	130671	78867	10627448	\$285,600,000,000.00	134.75
Denmark	73929	43094	5569077	\$211,300,000,000.00	129.23
Dominican Republic	19705	48670	10349741	\$101,000,000,000.00	212.65
Ecuador	43670	283561	15654411	\$157,600,000,000.00	55.21
Egypt	137430	1001450	86895099	\$551,400,000,000.00	86.77
El Salvador	6918	21041	6125512	\$47,470,000,000.00	291.12
Eritrea	4010	117600	6380803	\$4,717,000,000.00	54.26
Estonia	58412	45228	1257921	\$29,940,000,000.00	27.81

Ethiopia	44359	1104300	96633458	\$118,200,000,000.00	87.51
Finland	78000	338145	5268799	\$195,500,000,000.00	15.58
France	1028446	643801	66259012	\$2,273,000,000,000.00	102.92
Gabon	9170	267667	1672597	\$30,060,000,000.00	6.25
Gambia, The	3740	11295	1925527	\$3,678,000,000.00	170.48
Georgia	19109	69700	4935880	\$27,300,000,000.00	70.82
Germany	645000	357022	80996685	\$3,227,000,000,000.00	226.87
Ghana	109515	238533	25758108	\$90,410,000,000.00	107.99
Greece	116960	131957	10775557	\$267,100,000,000.00	81.66
Guatemala	11501	108889	14647083	\$81,510,000,000.00	134.51
Guinea	44348	245857	11474383	\$12,560,000,000.00	46.67
Guinea-Bissau	3455	36125	1693398	\$2,005,000,000.00	46.88
Haiti	4266	27750	9996731	\$13,420,000,000.00	360.24
Honduras	14742	112090	8598561	\$39,230,000,000.00	76.71
Hungary	199567	93028	9919128	\$196,600,000,000.00	106.63
India	4689842	3287263	1236344631	\$4,962,000,000,000.00	376.1
Indonesia	496607	1904569	253609643	\$1,285,000,000,000.00	133.16
Iran	198866	1648195	80840713	\$987,100,000,000.00	49.05
Iraq	59623	438317	32585692	\$248,000,000,000.00	74.34
Ireland	96036	70273	4832765	\$190,400,000,000.00	68.77
Israel	18566	20770	7821850	\$274,500,000,000.00	376.59
Italy	487700	301340	61680122	\$1,805,000,000,000.00	204.69
Jamaica	22121	10991	2930050	\$25,130,000,000.00	266.59
Japan	1210251	377915	127103388	\$4,729,000,000,000.00	336.33
Jordan	7203	89342	7930491	\$40,020,000,000.00	88.77
Kazakhstan	97418	2724900	17948816	\$243,600,000,000.00	6.59
Kenya	160878	580367	45010056	\$79,900,000,000.00	77.55
Korea, North	25554	120538	24851627	\$40,000,000,000.00	206.17
Korea, South	104983	99720	49039986	\$1,666,000,000,000.00	491.78
Kosovo	6955	10887	1859203	\$14,110,000,000.00	170.77
Kuwait	6608	17818	2742711	\$165,800,000,000.00	153.93
Kyrgyzstan	34000	199951	5604212	\$14,300,000,000.00	28.03
Laos	39568	236800	6803699	\$20,780,000,000.00	28.73
Latvia	72440	64589	2165165	\$38,870,000,000.00	33.52
Lebanon	6970	10400	5882562	\$64,310,000,000.00	565.63
Lesotho	5940	30355	1942008	\$4,265,000,000.00	63.98
Liberia	10600	111369	4092310	\$2,898,000,000.00	36.75
Libya	100024	1759540	6244174	\$73,600,000,000.00	3.55
Lithuania	84166	65300	3505738	\$67,430,000,000.00	53.69
Macedonia	14038	25713	2091719	\$22,570,000,000.00	81.35
Madagascar	34476	587041	23201926	\$22,030,000,000.00	39.52
Malawi	15450	118484	17377468	\$15,020,000,000.00	146.67
Malaysia	144403	329847	30073353	\$525,000,000,000.00	91.17
Mali	22474	1240192	16455903	\$18,900,000,000.00	13.27

Mauritania	10628	1030700	3516806	\$8,204,000,000.00	3.41
Mexico	377660	1964375	120286655	\$1,845,000,000,000.00	61.23
Moldova	9352	33851	3583288	\$13,250,000,000.00	105.85
Mongolia	49249	1564116	2953190	\$17,030,000,000.00	1.89
Morocco	58395	446550	32987206	\$180,000,000,000.00	73.87
Mozambique	30331	799380	24692144	\$28,150,000,000.00	30.89
Namibia	44138	824292	2198406	\$17,790,000,000.00	2.67
Nepal	10844	147181	30986975	\$42,060,000,000.00	210.54
Netherlands	139295	41543	16877351	\$696,300,000,000.00	406.26
New Zealand	94160	267710	4401916	\$136,000,000,000.00	16.44
Nicaragua	22111	130370	5848641	\$27,860,000,000.00	44.86
Niger	18949	1267000	17466172	\$13,980,000,000.00	13.79
Nigeria	193200	923768	177155754	\$478,500,000,000.00	191.78
Norway	93870	323802	5147792	\$282,200,000,000.00	15.9
Oman	60240	309500	3219775	\$94,860,000,000.00	10.4
Pakistan	262256	796095	196174380	\$574,100,000,000.00	246.42
Panama	15137	75420	3608431	\$61,540,000,000.00	47.84
Papua New Guinea	9349	462840	6552730	\$19,960,000,000.00	14.16
Paraguay	32059	406752	6703860	\$45,900,000,000.00	16.48
Peru	140672	1285216	30147935	\$344,000,000,000.00	23.46
Philippines	213151	300000	107668231	\$454,300,000,000.00	358.89
Poland	412035	312685	38346279	\$814,000,000,000.00	122.64
Portugal	82900	92090	10813834	\$243,300,000,000.00	117.43
Puerto Rico	26862	13790	3620897	\$64,840,000,000.00	262.57
Qatar	9830	11586	2123160	\$198,700,000,000.00	183.25
Romania	84185	238391	21729871	\$280,700,000,000.00	91.15
Russia	1283387	17098242	142470272	\$2,553,000,000,000.00	8.33
Rwanda	4700	26338	12337138	\$16,370,000,000.00	468.42
Saudi Arabia	221372	2149690	27345986	\$927,800,000,000.00	12.72
Senegal	14008	196722	13635927	\$27,720,000,000.00	69.32
Serbia	44248	77474	7209764	\$80,470,000,000.00	93.06
Sierra Leone	11300	71740	5743725	\$9,156,000,000.00	80.06
Slovakia	43916	49035	5443583	\$133,400,000,000.00	111.01
Slovenia	38985	20273	1988292	\$56,500,000,000.00	98.08
Somalia	22100	637657	10428043	\$5,896,000,000.00	16.35
South Africa	364131	1219090	48375645	\$595,700,000,000.00	39.68
Spain	683175	505370	47737941	\$1,389,000,000,000.00	94.46
Sri Lanka	114093	65610	21866445	\$134,500,000,000.00	333.28
Swaziland	3594	17364	1419623	\$6,259,000,000.00	81.76
Sweden	579564	450295	9723809	\$393,800,000,000.00	21.59
Switzerland	71464	41277	8061516	\$370,300,000,000.00	195.3
Syria	69873	185180	17951639	\$107,600,000,000.00	96.94
Taiwan	41475	35980	23359928	\$926,400,000,000.00	649.25
Tajikistan	27767	143100	8051512	\$19,200,000,000.00	56.26

Tanzania	86472	947300	49639138	\$79,290,000,000.00	52.4
Thailand	180053	513120	67741401	\$674,300,000,000.00	132.02
Timor-Leste	6040	14874	1201542	\$25,410,000,000.00	80.78
Togo	11652	56785	7351374	\$7,348,000,000.00	129.46
Tunisia	19418	163610	10937521	\$108,400,000,000.00	66.85
Turkey	385748	783562	81619392	\$1,167,000,000,000.00	104.16
Turkmenistan	58592	488100	5171943	\$55,160,000,000.00	10.6
Uganda	20000	241038	35918915	\$54,370,000,000.00	149.02
Ukraine	169694	603550	44291413	\$337,400,000,000.00	73.38
United Arab Emirates	4080	83600	5628805	\$269,800,000,000.00	67.33
United Kingdom	394428	243610	63742977	\$2,378,000,000,000.00	261.66
United States	6586610	9826675	318892103	\$16,720,000,000,000.00	32.45
Uruguay	77732	176215	3332972	\$56,270,000,000.00	18.91
Uzbekistan	86496	447400	28929716	\$112,600,000,000.00	64.66
Venezuela	96155	912050	28868486	\$407,400,000,000.00	31.65
Vietnam	206633	331210	93421835	\$358,900,000,000.00	282.06
Yemen	71300	527968	26052966	\$61,630,000,000.00	49.35
Zambia	91440	752618	14638505	\$25,470,000,000.00	19.45
Zimbabwe	97267	390757	13771721	\$7,496,000,000.00	35.24

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